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GAS LIGHT JOURNAL

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THE LONDON GAS COMPANIES.

It is doubtless well-understood by most of our readers that a full publication of accounts, according to prescribed form, is required by law of all the gas companies in Great Britain.

In the first place, a company cannot issue as much stock and bonds as it sees fit; neither can it increase either its stock or bonded indebtedness without an Act of Parliament. The proceedings are practically as follows: A bill is presented and referred to a committee; the promoters of the bill must satisfy the committee that the amount of capital proposed to be raised is a fair and reasonable one to do the work required; and it often happens that, after investigation, the committee do not recommend the sum asked for but a smaller one. The idea of this is to make the investment a safe one, and to prevent "watering," so that it follows that the capital stock of those companies may be generally taken as a fair indication of the value of their respective plants.

This has proved a great benefit in bringing about the adjustments necessary to consummate the various amalgamations that have taken place. Of the six Metropolitan companies the recent issue of Mr. John Fields' analysis furnishes some very interesting statistics. The amount of capital is shown as follows:

	Capital Authorized.	Capital Employed.	Capital Employed per 1,000 feet of gas sold.
	£	£	s. d.
Chartered	10,826,500	8,726,500	16 5
Commercial	1,130,000	690,000	11 0
London	1,052,696	864,014	13 9
Phœnix	1,244,000	1,162,000	14 1
South Metropolitan	1,000,000	500,000	10 1
Surrey Consumers	310,000	290,000	11 6
Total	15,563,196	12,232,514	Av. 15 0

The last column of this little table is very interesting, as it shows that the amount of capital employed, per thousand feet of gas sold, varies from $2.50 to $4.00; this is one of the reasons why gas is sold so much cheaper in London than in this country.

Of the 12 millions sterling of capital employed, 7 millions is entitled by law to standard dividend of 10 per cent., and 1¾ millions is loan capital; the other 3¼ millions is made up of different kinds of share capital, bearing interest at rates varying from 4 to 7½ per cent.

One reason why the capital of the Chartered Company is so much in excess of the South Metropolitan is that in the very large extensions of their plant, made by the construction of the Beckton station, they have been obliged to make a heavy outlay for land and buildings, which, though not now used to its full capacity, will certainly be required; and when the same is fully employed, the increase in "send out" will greatly reduce the capital "per thousand feet sold."

The amount of capital per thousand has of course a very direct influence on the price of gas. The following table will show this at a glance:

	Capital employed per 1,000 ft. of gas sold.	Price charged per 1,000 feet.	Dividend pr ct. declared for 1878.
	s. d.	s. d.	
Chartered	16 5	3 6 to 4 4	10½
Commercial	11 0	3 5	10½
London	13 9	3 3	10
Phœnix	14 1	3 4	10
South Metropolitan	10 1	3 0	11½
Surrey Consumers	11 6	3 9	10

The London *Metropolitan*, a journal devoted to public matters, in reviewing the reports, speaks thus of the operations of the companies, as regards their results:

"We have prepared a table showing the quantity of coals carbonised during the past year, and the quantity of gas made and sold.

	Coals Carbonized.	Gas Made.		Gas Sold.	
		Thousands.	Per Ton.	Thousands.	Per ct. on make
	Tons.		Cu. Ft.		
Chartered	1,108,604	11,406,303	10289	10,635,890	93.25
Commercial	137,469	1,389,630	10109	1,258,818	90.59
London	132,122	1,312,414	9933	1,258,059	95.48
Phœnix	174,280	1,751,028	10041	1,650,215	94.24
South Metropolitan	108,255	1,066,175	9849	992,869	93.12
Surrey Consumers	54,912	543,009	9889	502,677	92.57
	1,715,472	17,468,559	10181	16,293,528	93.27

"The results shown above do not differ very materially from those obtained in the previous year. There is an increase in the quantity of coals carbonised by about 100,000 tons, and in the quantity of gas made by over 1,000,000 thousands.

"We confess, however, that we are somewhat surprised to see a falling-off in the quantity of gas obtained from each ton of coal carbonized, in respect of four out of the six companies. With all the improvements and inventions that are continually being brought forward for extracting the

very last foot of gas from the coal, one might have expected a change in the other direction. It is just possible, however, that a true economy may not lie in the employment of these inventions, which in some cases are of an exceedingly costly character, and this view is somewhat strengthened from the fact that the Chartered Company, which is notorious for its extravagance, shows, as a result of its very large expenditure, a slightly increased make of gas per ton of coals carbonized. At the same time, we certainly think that a decrease in the make should not be shown. The Surrey Consumers Company, for instance, last year made a smaller quantity of gas per ton than in either of the three previous years. In considering this point, there are, of course, other circumstances to be borne in mind; but, in glancing over the figures before us, these comparisons do strike one, and they are of some value as illustrations of the general results obtained from time to time. The make of gas per ton in 1877 averaged 10,137 feet, in 1876, 10,069, and in 1875, 9,892. The only other matter to which we propose referring this week is the cost of coals, and on this point, we should explain, our information is obtained solely from Mr. Field's book. The accounts of the companies simply state what was paid for coals in the course of the year, and no means whatever are afforded of ascertaining for any purposes of comparison the practical value or effect of the figures given. We have, therefore, compiled the subjoined table from the figures contained in Mr. Field's analysis:

	Cost of Coals.			Less Residuals.			Net cost of Coals.		
	Amount.	Per ton.		Amount.	Per ton.		Amount.	Per ton.	
	£	s.	d.	£	s.	d.	£	s.	d.
Chartered	864,034	15	7	469,780	8	6	394,254	7	1
Commercial	113,779	16	6	59,158	8	7	54,621	7	11
London	104 350	15	9	61,209	9	3	43,141	6	6
Phœnix	126,811	14	6	77,450	8	10	49,361	5	7
South Metropolitan	75,885	14	0	52,046	9	7	23,839	4	5
Surrey Consumers	44,569	16	2	25,470	9	3	19,099	6	11
	1329428	15	6	745,113	8	8	584,315	6	10

"Comparing these results with those shown in previous years, we find that the cost of coals in 1877 averaged 16s. per ton, in 1876 17s., and in 1875 19s. 4d., as against 15s. 6d. in 1878, while the net cost of coals in 1877 averaged 6s. 6d., in 1876 6s. 6d., and in 1875 9s. 1d. One would think that the Chartered Company, with its extraordinary facilities for landing material at Beckton and elsewhere, and with its enormous consumption, would have been able to secure contracts for coal at prices which would compare favorably with those paid by any other company; but instead of this we find that the price paid during the past year by the authorities at Horseferry-road was not only not the lowest, but was actually above the average price paid by the whole of the companies, while the net cost of their coals was, with one exception, higher than that shown by either of the other companies, and nearly 4d. above the average. It may be that, in the opinion of the directors, the extra yield of a hundred feet of gas per ton of coals carbonized fully compensates for this difference in price, notwithstanding the fact that their receipts by the sale of residuals were 3d. below the average; but it may also be a fact, as in the opinion of some competent judges is the case, that the company is not particularly anxious, as a matter of policy, to increase its condition of prosperity much beyond that at present attained, for fear that unreasonable and extravagant profits may again excite the feelings of the public in regard to their proceedings. Our own impression is that those who hold this latter view are not very far wrong. We cannot persuade ourselves that the company is striving to carry out the spirit of the Act, nor can we think that the company is disposed to give to the public that advantage in the form of a reduced price, which it was manifestly the intention of the Legislature the public should secure. We cannot of course say how long the metropolis will be prepared to put up with the present state of affairs; but, as we have repeatedly said, while the inhabitants of places like Birmingham and Manchester can obtain good gas at prices ranging from 2s. to 3s. per 1,000 feet, it is a monstrous thing that the inhabitants of London—the metropolis of the world—should be compelled to pay these monopolists 3s. 6d. and 3s. 9d. for an article that is wretched and insufficient for its purpose in the extreme when compared with that supplied to many provincial cities and towns. On a future occasion we hope to be able to return to this subject, and to submit further extracts from the accounts before us, but for the present probably we have been able, in the figures given above, again to place before our subscribers information on this most important subject which may prove most useful."

The views and criticisms above given are very fair when the standpoint of the *Metropolitan* is considered; but, certainly, it cannot be accused of any favoritism towards the gas companies. We never have been able to see why any municipal corporation should go into the gas business any more than they should supply those who require such things with flour, bread, beef, calico, shoes, or any other of the necessaries of life. Yet, there are some fine things in England that have been done out of gas profits, for the general good, at the expense of a part only of the community.

The *Journal of Gas Lighting*, in speaking of these same accounts, uses the following words:

"The accounts of the Metropolitan Gas Companies for the year 1878 have just been issued, and our usual abstract will appear in a short time. The accounts illustrate, as usual, the continued prosperity of the companies, which makes them the envy of all opposed to their interests. It must, however, be admitted on all hands, that the supply of gas to the Metropolis is so excellent, and the charge so moderate, that there is now nothing to be alleged against the management of the companies. All agitation has ceased, and consumers now recognize that their interests are fully considered. The number of companies has now dwindled to six, and next year we hope that the accounts of only five will be rendered. We look forward hopefully to the time when only one or at the most two gas companies will exist in London, by which combination the interests of every one concerned will be promoted."

The Outlook.

The outlook in petroleum in all its branches never was more gloomy than at the present time, and the worst feature of the situation is that there seems no prospect of any change for the better in the near future. In saying this we are not unmindful of the fact that the petroleum business has been marked in the past by the most marvellous changes; periods of the most utter and hopeless depression being followed by the most unexpected improvement. But at these times there have been some redeeming features in the depression, at the present time there does not seem to be one hopeful sign, but in every department—production, stocks, values and marketing—all seem to present the worst features imaginable. It may be thought that the large increase of consumption indicates a favorable condition of the market, and this would be true if it were not a fact that production has increased in a greater ratio than consumption. This increase in consumption has doubtless been stimulated by the low prices ruling; and could not be maintained were there to be any marked increase in prices, so that even it cannot be regarded as a healthy indication.

Among the most discouraging features of the market is the large increase in production in spite of low prices, heavy stocks, and a constantly declining market.

The daily average production for the month of June, 1878, was 40,575 bbls., in June, 1879, it was 55,105 bbls., being an increase of 14,530 bbls.

This increased production is entirely in the northern or Bradford regions, which has been stimulated by the ease and certainty of obtaining oil, coupled with the small expense of producing it after the well is completed, as nearly all of the wells in this field flow, which leaves the machinery free for the operator to use in drilling new wells. Dry holes are comparatively rare, except now and then a wild cat well drilled in extending the territory or defining its limits.

With these facts plainly before us, to whom or where shall we look for relief? Evidently not to stopping the drill, for the failure of all former efforts in that direction forbid it.

Not to the want of prolific territory, for nature always furnishes a bountiful supply for the necessity. Not to anti-discrimination, as free and open competition in freights (however correct in principle) will not furnish a market for our surplus product.

The most feasible course out of the dilemma is evidently in the direction of extending largely its present uses at home, and seeking new fields for it abroad. Also in applying it to new uses on a large scale until the world's need is equal to the amount produced.—*Stowell's Petroleum Reporter.*

[Official Notice.]

Second Quarterly Meeting of the Central New York Gas Engineers' Association.

A regular meeting of the Central New York Gas Engineers' Association will be held in parlor A, Brackett House, Rochester, N. Y., on Thursday, Aug. 21, 1879, at 11 o'clock A. M. It is earnestly hoped that there will be a full attendance of members, and that they will prepare papers on such topics as shall be of interest to themselves and other members of the Association.

Article 3 of the Constitution gives the qualification for membership as follows:

"Article 3. Any gas engineer, superintendent, or person actively engaged in the management of gas works, within the boundaries hereinafter named, may become an active member of this Association, upon application in writing to the Secretary, addressed to the Association, and an election by two-thirds of the votes at any regular meeting of the Association, and signing this Constitution.

"Article 15. The boundary of the Association shall be all that portion of the State from and including Utica, west to the State line."

The head-quarters of the Association will be at the Brackett House.

Clement A. White, *Secretary.*

[From London "Journal of Gas Lighting."]

The Select Committee on the Electric Light.

The report of the Select Committee of the House of Commons on Electric Lighting may be received as a document which is not likely to err on the side of antagonism to the new mode of illumination. Without saying that the Committee was at all blind to the faults of the electric light, we may suggest that it was at least kind to its virtues. As toward gas, the feeling was perhaps somewhat different, and we cannot but apprehend that the mode in which the inquiry was conducted scarcely admitted of a full hearing for what may be called the old light. It might be said that this was true of the evidence for the new light also. In all cases the chairman of the committee asked such questions as he thought fit, and it is quite possible that several things which witnesses desired to say were left unsaid. When a Select Committee has a bill before it, both supported and opposed by counsel, the system of examination and cross-examination serves to bring out all the points. This valuable assistance is wanting when a committee sits merely to conduct an inquiry.

In the present instance the committee were naturally desirous to learn all that they could in respect to the electric light, and it is not likely that they would care to hear everything that might be said by a witness supposed to be connected with the gas companies. However, we need not quarrel with the issue. It is well that the new candidate should have the best possible chance. A fair opportunity has been given to the advocates of the electric light to say what they can in its behalf, and we may consider that they stated their case to willing ears, so that no injustice has been done to their side of the question.

On these grounds we feel justified in saying that the report of the committe may be held to state the case as favorably as it can be stated on behalf of the electric light. In that respect nothing can be added to the report, except it be that, since the inquiry closed, experiments have been conducted which show that the electric currents can be carried to a greater distance than was formerly thought practicable. Looking, therefore, into this official document, in order to see how far the electric light has proved successful, we find it stated that, "Compared with gas, the economy for equal illumination does not yet appear to be conclusively established." The committee say that, although in some cases the relative economy for equal candle power is on the side of the electric light, "yet in other cases gas illumination of equal intensity has the advantage." Hence we are told that "unquestionably the electric light has not made that progress which would enable it, in its present condition, to enter into general competition with gas for the ordinary purposes of domestic supply." "So far as we have received evidence," say the committee, "no system of central origin and distribution suitable to houses of moderate size has hitherto been established."

It will thus be seen how far the electric light falls short of the sanguine expectations entertained in some quarters a few months ago. Admitting that the electric light is in a progressive stage, there is yet no definite promise as to the future. It has proved itself available for lighthouse illumination, though we believe that even there it is not wholly relied upon, some other mode of illumination being kept in reserve in case the electric apparatus should fail. The committee also say the light is "fitted to illumine large symmetrical places, such as squares, public halls, railway stations, and workshops."

We are also told that "many trials have been made for street illumination with greater or less success." The Holborn Viaduct, we presume, is not a case in point, nor even Mr. Hollingshead's display outside the Gaiety. The committee might have said that the electric light has been tried out of doors in certain cases, and has proved "more or less of a failure." But it does not say this. Mr. Keates very clearly shows that the electric light on the Victoria Embankment costs nearly sixpence per hour per lamp, while equivalent light from gas would cost only twopence, or, if a frosted instead of the opal globe were used for the electric light, the equivalent of gas would be threepence halfpenny. The present charge for the electric light on the Embankment is fivepence per lamp per hour, but the Metropolitan Board has also to pay for the hire of the engine.

The Select Committee lays considerable stress on certain statements as to the "transformation of energy." On this point they received evidence from Sir William Thompson, Dr. Siemens, and Mr. Hopkinson. In our report of the evidence given before the committee Sir William appears as saying, "The energy which is actually used in the production of the electric arc is about 1-horse power per 2,400, or even more, candle power, according to the dimensions and other circumstances of the electric arc. One-horse power of energy in the combustion of gas produces about 12-candle power." We believe this is really what Sir William said. In the report of the Select Committee, the question takes the following form: "A remarkable feature of the electric light is that it produces a transformation of energy in a singularly complete manner. Thus the energy of 1-horse power may be converted into gas light, and yields a luminosity equal to 12-candle power; but the same amount of energy transformed into the electric light produces 1,600-candle power."

Referring again to the evidence given before the committee, we find Sir William replying to Lord Lindsay: "With regard to what I said as to the 2,400-candle electric light being produced by 1-horse power, that would be 1-horse power net, after taking off what is required for the friction and heating of the machine." In order to give as accurate a view as possible of what Sir William really intended to say, we quote another passage in his evidence. After stating that in one experiment he made use of a very feeble electric light produced by a battery, Sir William went on to say: "I have made several measurements, with the assistance of Professor Tait, upon a much more powerful electric light produced by a Gramme machine driven by a gas engine. Allowing the practical estimate of 1-horse power actually spent in driving the engine to produce 1,200 candles, which has been realized, I estimate that one-half of the power goes to the electric arc and one-half is lost in heating different parts of the machine. This, then, gives 2,400 candles per one-horse power."

We must say this appears rather a lame way of making up the candle power of the electric light. To our mind it entirely fails to justify the statement in the report, which declares—"A remarkable feature of the electric light is that it produces a transformation of energy in a singularly complete manner." According to Sir William Thompson "one-half the energy is lost in heating different parts of the machine." How, then, can it be said that the electric light exhibits a complete transformation of energy? The completeness extends to one-half, the other half giving no luminosity. At the utmost, the 1-horse power applied to the production of the electric light is equal to 1,200 candles, according to the evidence of Sir William Thomson, while the committee put it up to 1,600 candles. To make matters still worse, it is stated, on the authority of the same gentleman, that the energy of 1-horse power converted into gas light is only equal to 12 candles. According to his own mode of dealing with the problem, Sir William may be right, but we venture to propose another kind of calculation, which at least possesses the advantage of being plain and practical. We take a ton of coal as capable of producing, by its distillation in a retort, as much as 10,000 cubic feet of 16-candle gas. Of course, to do this, the coal must contain a certain proportion of cannel, which, in the case of one London company, is about 9 per cent. In reality, the gas has a lighting power exceeding 16 candles, but of that we take no account. In the experiments on the Victoria Embankment, as reported by Sir J. Bazalgette and Mr. Keates, it appears that the consumption of coal per indicated horse power was four pounds per hour. For the nominal horse power the consumption of coal must have been higher, but we will simply take the four pounds. This quantity of coal will produce, in round numbers, 18 feet of gas, equal to 57 candles per hour. But, as a matter of fact, more light could be obtained from the coal if the companies saw fit to get all the light they could out of it. It is simply a question of economy whether the coal should be converted as far as possible into gas, or whether the process should stop at a certain point. Some of our readers will remember the process devised by Dr. Eveleigh, which led to the establishment, for a time, of the Patent Gas Company. Dr. Eveleigh's plan was to use not only the coal, but also the tar, in the production of gas, and in that way he obtained a large additional amount of candle power from a given quantity of coal. Economically the plan did not answer, and it might be almost literally said "the game was not worth the candle."

The fallacy of the comparison made between the candle power of gas and the electric light is thus apparent, when we consider that in the manufacture of gas there is a large amount of "energy" which takes the form of residual products. It might please a philosopher to convert all the energy in a pound of coal into gas, but a commercial enterprise differs somewhat from a scientific experiment, and shareholders require to see a certain amount of "energy" represented by dividends. The experiment must not only look pretty, it must also pay. If a gas company were compelled by act of parliament to get all the candle power they could out of their coal, without any regard to the value of the residual products, the directors would be oblighed to charge a higher price for the gas. We can assure Dr. Playfair and Sir W. Thomson that "energy" is not lost when it takes the form of coke, breeze, tar, and ammoniacal liquor. When power is applied to the production of the electric light, the only marketable result is the light itself. The heat brings no money to the exchequer, though Sir W. Thomson has suggested that when the Niagara Falls are made to work dynamo-electric machines, the waste heat should be turned to account by creating a flow of hot water in the conducting tubes. This is something like "shooting Niagara," and we can only say, "What next?" Will a future generation be invited to take shares in the "Electric Light, Power, and Hot Water Company, Limited?"

In comparing the two lights it should also be taken into consideration that, in producing the electric light, there is a consumption of carbon in the

lamps as well as in the furnace of the engine, and the cost thus incurred has much to do with the financial result. Moreover, as a matter of fact, 1-horse power, as applied to the electric lights on the Victoria Embankment, has barely given the light of 400 candles, subject to a further reduction owing to the use of frosted or opal globes.

Whatever may be in the womb of futurity with regard to the electric light, it is evident that at the present hour it is dearer than gas for the purpose of street illumination in London. This may not continue to be the case, and it is evident that every effort will be made to compete with gas on equal terms, and, if possible, even at a cheaper rate. But, while hopeful as to street lighting by electricity, Sir Bazalgette and Mr. Keates state at the close of their recent report that, as concerns the electric light, "at present there are defects connected with it that must prevent its adoption as a general mode of lighting competing with gas." "There is, say these authorities, "in our opinion, no prospect at present of any such general competition."

It is difficult to know what value is to be attached to the words "at present." They seem to suggest a lurking expectation that by and by the state of the case will be altered. But the by and by may be a long way off, and the words may only be intended to guard against a remote and unlikely contingency. "At present" we see no signs of a flying machine carrying the mails across the Atlantic; but we need not commit ourselves by saying there is absolutely no prospect of such a thing being accomplished. If by making use of waterfalls the advocates of the electric light manage to get their motive power for nothing, they will save coal, and, so far, gain an advantage over gas. At present we do not see how to make gas profitably out of water, whether it comes in a cascade or in a flowing stream. But the waterfall question involves the other consideration as to the distance to which the electric current can be conveyed. On this point some very interesting experiments have been performed with the Gramme machines and Jablochkoff lights on the Victoria Embankment. It has been found practicable to sustain the lights at a distance of two miles from the generating machine, and there is no indication that this is the final limit. Further experiments are pending, for the purpose of trying a longer distance. The conducting cable has remained unaltered in size, notwithstanding the extension of the circuit. From these results it is naturally argued that the lighting of the streets and railway stations from an electric centre is a possible event.

Street lighting, we may observe, offers a tolerably wide field for the electric light, if the latter is able so occupy it. Not only is there a considerable distance to be traversed, but there are an immense number of lights to deal with. At the close of last year the Chartered Company had 35,387 public lamps in their district; the Phœnix, 6,064; the London, 5,227; the Commercial, 4,756; and the South Metropolitan, 4,207. These make a total of 55,641. The Surrey Consumers' Company had 2,087 public lamps in 1877, so that we may now reckon that the total for all London is about 58,000. Mr. Keates has calculated that the 20 electric lights on the Embankment could take the place of 86 gas lamps. At this rate 13,500 electric lamps would be required for all London, and probably more, taking into account the courts and alleys, which have to be lit, where a powerful light would be partially wasted. In computing the horse power requisite to maintain such an illumination, it is only fair to observe that the gross horse power should be taken, and not merely the net. At all events we may reckon that a total of 13,000-horse power would be requisite to obtain these lights. There is nothing impossible in street lighting by electricity; but of itself it does not seem to offer a promising investment, at least where gas is cheap, as in London.

Railway stations may take advantage of the electric light, but many practical points have to be got over before any decided advance will be made. Experiments will abound, lights will come and go, and much time will inevitably be expended ere gas can suffer any material displacement. While this process is going on, other changes will be taking place, including, in all probability, an enlarged demand for gas in various directions. If the gas companies are wise they will be active and enterprising, without being alarmed. The idea that they are to act as the providers of light, whether in the form of gas or electricity, must be held with moderation. There is no need to dispute the opinion of the Select Committee, that "gas companies have no special claims to be considered as the future distributors of the electric light." But, on the other hand, the gas companies ought not to be absolutely shut out from such a function, though separate powers might be requisite, so as to keep the two undertakings distinct. The argument that if the electric light were committed to the gas companies they would possibly give it "a slow development" is plausable, and appeals to the popular prejudice, but much would depend upon the terms of the concession. If these were fairly arranged, the gas companies would find it to their interest to make the very best of the electric light, presuming the new illuminant to be capable of commercial development.

A little prophesying is evidently requisite with regard to the electric light. The Committee's report says that "many practical witnesses" see serious difficulties in the speedy adaptation of the electric light to useful purposes of illumination, but, on the other hand, the "scientific witnesses" believe that in the future the electric light is "destined to take a leading part in public and private illumination." There is an idea that the electric current might be used to transmit power for mechanical purposes during the day, and to afford light during the night. How matters are to be arranged during the dark days we are not told. The choice might sometimes lie between working in the dark and kindling a light and doing nothing. That the electric current will render important service in the transmission of power is extremely likely, and perhaps more rapid progress will be made in this direction than in regard to the application of the light. Some striking results in the transmission of the electric power have been obtained in France, and when attention is more earnestly directed to this part of the subject the electric light will probably lose some of its assumed importance.

[From the London "Journal of Gas Lighting."]

British Association of Gas Managers.

Mr. C. Sellers (York) read a paper on

COKE: THE BEST MEANS OF UTILIZING IT.

After the scientific papers we have had the pleasure of listening to, it may be a relief to have one such as I am about to submit—a paper, in fact, which claims to have no other merit than that of simplicity. It is true that gas manufacture embraces many abstruse problems, and covers a field in which the highest scientific attainments may find ample and profitable employment; but while there is the scientific field in the gas world, there is also the commercial, and it is to the latter that I wish to ask your attention for a few moments.

The text of my paper is "Coke: the Best Means of Utilizing It." To a stranger this text might appear superfluous, since the natural promptings and necessities of a gas manager will induce him to utilize it in the best possible way. In the first place, if coke accumulates, it is unwieldly, bulky, and a nuisance; so much so that I have sometimes heard gas managers of a demonstrative turn of mind refer to mountains of coke in their yards, in terms which were neither rural nor poetical. Indeed, of late years gas coke, both at home and abroad, has often figured in the half-yearly reports as a complete drug, and in some cases it has not realized more than 2s. 6d. per ton. This, of course, may partly arise from inferior quality, bad trade, or keen competition. The company I represent use North coal exclusively, and therefore our coke usually ranks with the best.

As a product in gas manufacture coke stands to the front, and yields substantial revenue; therefore it is deserving of special consideration. I say special, because its utilization depends more upon the ingenuity and commercial activity of the gas manager than perhaps does ony other residual he has to deal with. A gas manager cannot influence the value of tar or of ammoniacal liquor, but I hold that he can influence the value of coke. In making this statement I desire to make every allowance for the local trade of a town, and the competition with coal. But, without further introduction, I will at once detail what I have done at York, and if any gentleman present can get from my experience any suggestion or idea which he can turn to good account, my object will be served.

As with most gas companies, before gas became popular, the quantity of coke with the York Company was limited, and consequently easily disposed of. Indeed, 30 years ago coke was sold in job lots by the cart load or wagon load, and often without any regard to exact quantity or measurement. This practice may be said to belong to the good old times, before the invention of sliding scales and photometers, and before ever Lord Redesdale was heard of. Now, however, the times are changed, and it behoves every gas manager to make the most he possibly can of his residuals.

Up to four years ago the York Company had not much difficulty in selling their coke at a fair price. York is an agricultural district, and during the long period when chicory threatened to take the place of coffee, the city was regarded as a great chicory centre, and our company sold large quantities of coke for drying that article. When the demand fell off the trade of the city fortunately increased, and our surplus coke was easily disposed of for malting and trading purposes. But during the last three or four years, when the make of coke has been slowly increasing, the demand for trade purposes has been gradually getting less. This has arisen from two causes —first, from bad trade, ; secondly, from competition, arising from the introduction of manufactured coke from the collieries. To meet these new conditions, and to create for coke a demand more permanent than the demand for chicory purposes and the fluctuating requirements of trade, we have had to borrow considerably from the commercial instinct, and instead of waiting, as of old, for customers to fetch our coke, we have practically taken coke to our customers. We have had to rely more than ever upon the domestic demand, and popularize coke for household use.

In the first place, when we commenced to specially advertise coke for domestic purposes, we found that orders entrusted to hired coal carters were not always faithfully executed. Human nature, as a whole, has nothing to boast of in point of its integrity, and ordinary coal carters are not usually the finest specimens. They are a poor class, subject to sharp competition, and often driven to unmentionable expedients to "earn a crust." Besides, ordinary carters are often under the influence of coal dealers, and, therefore, instead of pushing the sale of coke, they not unfrequently stimulate a prejudice against it. To meet this difficulty, we secured horses and carts and lurries of our own, which gave great satisfaction to our coke customers. They feel now that the coke which passes over our weigh-bridge is delivered to them, and they are not overcharged for cartage. And, bearing upon this question of cartage, I may just observe that a company having its own means of delivery possesses a great advantage over one that has not.

An uniform price of coke must be maintained to all customers alike, but cartage is a flexible item, and we have sold many tons to crotchety people who like to banter and make bargains. For instance, we fix all our charges for delivery, just to pay working expenses; but where a customer says he will not have coke except we deliver it at his own cartage price—say 3d. or 6d. off the regular cartage—we oblige him. In addition to our own lurries and carts, we last winter added wheelbarrows, which we lent to poor people who fetched their own coke, and so saved the cost of cartage. At first we lent the wheelbarrows without charge, with the result that sometimes we had to fetch them back ourselves, while on two occasions our barrows were left in the streets—not positively drunk, but incapable of getting home again, and, therefore, had to be taken in charge by the police. We now demand one penny for the loan of a wheelbarrow, and return the money if the barrow is brought back at once. This rule, I may add, works well.

Our next difficulty within the domestic circle was a strong prejudice, or, rather, objection to the use of coke for household purposes, because it required breaking. Whether the generally expressed opinion that domestic servants have of late been very much given to do the least possible amount of work in the greatest possible space of time be true or not, forms no part of my paper; but I do know that they have a decided objection to break coke. Well, to meet this objection—for we heard of it on all sides—we last autumn invented a hammer of a shape which made it almost useless for any other purpose than breaking coke or coal, and therefore rendered it less likely to be taken out of the place where coke is kept. This hammer, of cast steel, and shafted complete, cost 1s., and we gave one to each coke customer who sent for a load. This presentation hammer was of great benefit, for it was of a shape which chopped the coke, and so broke it very easily. Besides, there is a fascination about a thing that is given, and both well-to-do and poor people had their attention roused to the use of coke from this simple circumstance. We had orders given in various forms, but many of our customers never failed to add the significant request: "Please send me *an 'ammer*.

I next heard of a machine for breaking coke by steam power, at the Victoria Foundry, Leeds. I went over, had an interview with Messrs. Smith, Beacock, and Tannett, the owners of the foundry, and finally ordered them to make a machine similar in principle to theirs, but with a few minor improvements. I also procured a 4-horse vertical engine, and after placing both engine and breaker on wheels, so as to be able to move them to any particular stack of coke, commenced, on the 4th of February last, to break coke by steam power. This, of course, was a great occasion, and we immediately announced the circumstance, not only in a standing paragraph at the back of every gas bill, but in a public advertisement headed: "Coke Broken by Machinery—A Boon to Householders," etc.; and I can only add that, so far, the result has not only been a boon to householders, but it has been a boon to the York Gas Company, which, though mentioned last, is not the least in the transaction.

It would be difficult for me to show the exact increase in our sales of coke for domestic purposes, attributable to our machine, because, if I compare the main portion of the time since we broke the coke with the corresponding period of, say, the last three winters, the contrast will be very delusive, on account of the extreme disparity in the weather. I will, therefore, content myself by saying that—

1. As far as I know, we have retained all our old customers, and gained many new ones, and that the ratio of coke now sold for domestic and for greenhouse purposes, as based on the sales of the two months, April and May, is 61 per cent. of the total, and that 45 per cent. of the domestic coke is broken. And without comparing the total sales during the winter, which, as I have already said, are necessarily influenced by the weather, I may add that during these two months, April and May, when the weather conditions of comparison affecting coke more closely approximate, our total sales of coke were 1402 tons, as against 1169 tons in 1878, showing an increase this year of 20 per cent. But, as the domestic coke is what I am more especially dealing with, I will give you the total domestic sales for April and May during the last four years. In 1876 the domestic sales were 352 tons, or 37 per cent. of the whole. In 1877 the sales were 733 tons, or 53 per cent.; in 1878, 589 tons, or 50 per cent.; and in the present year, 848 tons, or 61 per cent. of the total, showing an increase of domestic sales in the present year over 1876 of 141 per cent., over 1877 of 16 per cent., and over 1878 of 44 per cent. But as bare figures are somewhat delusive, I will add a word of explanation. In the year 1876 the price of our coke, during the two months referred to, was 15s. per ton, while in the three following years it has been only 10s. This fact would have some influence upon the sales at that time, although, of course, the price of coke must always bear a relationship to the prices of fuel it has to compete with. Then the sales in 1877 were exceptionally good—first, from the fact that we had in the preceding winter procured our own lurries and carts to deliver coke, and consequently we specially advertised the circumstance, and made it the occasion for drawing public attention to the use of coke as fuel; secondly, because house coals in 1877 were a little higher in price than now, and therefore gave us a better chance to sell our coke. But whether I under or over estimate any of these influences, the fact remains that our coke sales show satisfactory progress.

2. We have gained many customers who objected to coke because it was not broken, and many who objected to it because their coal places were not large enough to keep ordinary coke separate, but now, with coke broken, they can put it in the same place, and mix it with coal. This is an important point, and forms part of of our advertisement behind our gas bill heads.

3. Broken coke is more attractive than unbroken for engine purposes, greenhouses, and heating-stoves, such as Musgrave's slow combustion stoves, which are becoming very common in asylums, workhouses, and public institutions.

4. Coke does not create the dense smoke given off by coals, and therefore, apart from its not blocking up flues, its use should be encouraged upon sanitary and public grounds, and I have now reason to know that in two engine cases in York, where smoke was complained of, our broken coke supplanted coal.

Bearing upon this question I may say that Messrs. Smith, Beacock, and Tannett, of Leeds, use nothing but broken coke for their smiths fires, and in addition to the no-smoke advantage, they claim that broken coke makes cleaner and hotter fires than coal, and in the making up of the fires the first thing in the morning, and again after dinner, coke gets to a good working heat quicker than coal by from half to three-quarters of an hour per day, and this gain, multiplied by any given number of fires, is an advantage not to be ignored. The York Railway Plant Company also now use our broken coke for their smiths fires, and their experience fully confirms the statement made by Messrs. Smith, Beacock, and Tannett.

I am of opinion, then, that it is within the gas manager's province to make these advantages known in every possible way. The inducements to get rid of coke are, to the gas manager personally, that he gets rid of the trouble of stacking and holding coke; and to his employers, that it prevents depreciation, which stacked coke always undergoes. Our engine and breaker, and fitting up of same, cost £143, being, for the engine, £108; the breaker, $28; and fitting up, £7. But if any maker could be induced, say, by several orders, to place engine and breaker upon one frame, so that both could be moved upon one set of wheels, the cost would be materially reduced, and the work very much improved.

Our machine, when at full work, will break 20 tons of coke per day. We have one man to look after the engine, and two men to feed the machine; but as the first-named man is not fully occupied with the engine, he assists the other two men in helping carters to put the broken coke into bags, etc., the net cost of all which adds 9d. per ton to the price. Then in breaking a ton of coke about 1 cwt. passes through the screen, and is sold as breeze at 1s. 6d. per ton, or, say, 1d. per cwt. The real result, therefore of breaking coke stands thus:—We sell our unbroken coke at 10s. per ton, and broken at 10s. 8d.; the 8d. added being 9d. per ton for labor, and coke converted into breeze by breaking, less 1d. received for breeze per ton of coke broken. The cost of maintenance of engine and breaker we consider is more than recouped by, first, the saving of labor that would have been employed in loading the coke if it had not been broken; secondly, the saving in the cost of labor and depreciation of stacking of coke if it were not sold; and thirdly, the advantage gained in getting rid of the coke, so as to enable us to maintain our price of 10s. per ton, for upon our annual make of coke for sale a reduction of 1s. per ton would inflict a loss of £500 a year.

There is just one more point, and then I have done. I have referred to the breeze, or screenings, mainly created by breaking the coke. This breeze is pure coke, and, upon commercial or economical grounds, ought to have a higher value than 1s. 6d. per ton. So far, we have had no difficulty with ours. A railway contractor has taken all our surplus stock, and used it to make beds for railway sleepers. Some is sold for garden walks and footpaths, and for night fires in greenhouses, and last week I drew the attention of Mr. Alfred Waker, of the York Railway Plant Company,

to it and he determined to use it for his smiths' fires, or rather the rough portion of it. He illustrated the manner of separating the dust from the rough by putting a shovelful into a bucket of water, when the dust immediately sank to the bottom and the rough portions floated on the top. But what I wished to suggest was this: There is a method in France for mixing various combustible materials with pitch, and making the whole into solid lumps of fuel. Is it not possible to utilize this pure dust coke in some similar way?

Having now given my idear upon "The Best Means of Utilizing Coke," I shall be glad to her the opinions of others.

DISCUSSION.

Mr. Paterson (Warrington) thought 10s. a ton was a high price for coke, and asked what coal it was made from.

Mr. Sellers said that at York they were using North Pelton coal—one of the best gas coals in the Durham district.

Mr. Eldridge (Richmond) said he had often been surprised that gas managers had not sooner done as Mr. Sellers had done lately. At Richmond, for many years, they were entirely at the mercy of the coal and coke merchants, who would only come and buy coke when they thought proper. If they saw there was an accumulation, they would keep away until it became very large, so as to be able to get it at their own price. At last he suggested to his directors that they might go into the retail trade themselves. They advertised that they would deliver coke, and soon got up a good trade, and now they supplied nearly all the surrounding gentlemen, as well as Kew Gardens. The used to sell it for about 8s. a chaldron, and now they delivered it at 14s. a chaldron. At the present time they had orders on the books for 400 chaldrons, and had not 4 in stock. They also broke up the coke and charged for the breaking, though he had never before heard of the machine mentioned in the paper.

Mr. C. Gandon (Suydenham) thought the suggestion for promoting the sale of coke by breaking it was well worthy of adoption, and he had lately given an order for a breaking machine. His company had undertaken the delivery of coke for the last 14 or 15 years, and with very good results. They obtained a higher price than if they sent it out by coke dealers, besides giving more satisfaction to the consumers.

Mr. R. O. Paterson (Cheltenham) said they all admitted the necessity for breaking the coke for household purposes, but the question with him was what loss they would suffer by it. They knew that in the coke obtained from the retorts there was a certain proportion of breeze, which was a more or less fixed quantity; but, over and above that, there was a certain proportion made by the breaking process. In York they sold their coke unbroken at 10s. a ton, and broken at 10s. 8d. Against that there was a credit of 1s. 6d. for the breeze from the machine. He failed to see that that brought them any advantage. The breaking cost 9d., and the breeze obtained brought 1s. 6d.; but, seeing that every portion of the breeze made by the machine was so much lost coke to sell at 10s. a ton, he was not quite clear as to how they gained any advantage by it.

Mr. John West (Maidstone) said they had broken coke for the last nine years, and they had gone on increasing the sale year after year until now. They measured in the same way as large coke; but finding from practice that it took just 40 bushels of large coke to produce 36 of broken, they increased the price by the four bushels. Assuming that they sold coke at 9s. per chaldron, or 3d. per bushel, they charged 1s. extra for broken coke; but they did not charge for the breaking. They had boys to break the coke with hammers, but undoubtedly the machine would be a great advantage. During the whole winter they seldom had more than 20 chaldrons of coke in stock.

Mr. Sellers, in reply, said the figures he had given represented the actual working of the machine when fully employed. The coke was weighed in its rough state, and when broken the coke and breeze were each weighed separately, the breeze, of course, being deducted from the gross, so that the figures quoted were not estimates, but realities. Breaking a ton of coke gave off 1cwt. of breeze; but that was not all the result of the breaking, because if the coke were sold in its rough form, some of it would be avoided by the carters and left on the ground; but when it was all put into the hopper together, the small would run through with that produced by the breaking. The figure of 9d. per ton for labor, and coke converted into breeze by breaking, was an actual fact from their own experience, and one which he thought Mr. Paterson would now recognize.

The President said this question had already been brought before them by the Secretary, who probably had little idea that his practical recommendation would be so soon carried out, because there was at that time a very strong feeling that no advantage whatever was obtained in the breaking of coke. He could only say, from his own experience, that a large number of persons at South Shields came to the yard to gather the coke themselves, and they always ran up to the heaps to gather the large pieces. On the other hand, he had heard that people had objected to have coke, as the servants would not use it while it could be kept separate by being in a large condition. He had no idea that the breaking had such an effect upon the sale as it appeared to have. Another point of great advantage was the delivery of coke by the companies themselves. He had known dealers come into the yard and take coke away for delivery which was sold as a larger quantity than bought—sometimes they would make two loads into three. It was very remarkable that heaps of coke should accumulate in some places, as they did, especially in such towns as those in the North of England, where there were thousands of tons occasionally lying on hand. This discussion would probably not be quite pleasant to gentlemen present who contracted for some thousands of tons of coke in a year, and were benefitted by the condition of the coke market in that neighborhood, where the small householders could not be made to use it. He thought great advantage would arise from giving attention to this subject. In a pamphlet which he issued some time ago he showed that each gas consumer would only require to use about 5 cwt. of coke per month in order to dispose of the whole of it. Hence if each consumer would use this amount of coke, its value would be considerably enhanced.

Mr. J. A. G. Ross (Newcastle-on-Tyne*) read a paper on

THE APPLICATION OF HYDRAULIC MACHINERY TO GAS WORKS.

It occurred to me, when requested by your President, some short time ago, to write a paper for this meeting, that, as Newcastle-on-Tyne was the birthplace of the modern development of water-pressure machinery, and as there are so many notable examples of its application in this immediate neighborhood, some of which the members of the Association will have an opportunity of visiting during their excursions, a paper on hydraulic machinery, as applied to gas works, would not be unacceptable to the British Association of Gas Managers.

It will be quite unnecessary to enter into a history of the subject generally, or to go back to the labors of Bramah. It should, however, be stated that the present hydraulic system owes its origin and development to Sir William George Armstrong, C. B. The author remembers a little over twenty years ago seeing an apparatus at the Elswick Works, a rotary water-pressure engine, which was made in the year 1839. This was worked from the Water Company's main, and gave a very high efficiency, but was never, he believes, applied to active work. This was followed in the year 1846 by a 5-ton crane, erected on Newcastle Quay, for shipping and unshipping goods. This machine also was worked from the Water Company's mains, and showed very great efficiency, and has remained in operation until recently, it being now replaced by a more powerful crane.

In some cases, where water pressure was not available from town mains, the water was pumped by a steam engine to a reservoir on the top of a high tower, as at Grimsby and other places, to obtain the necessary pressure. These methods of obtaining hydraulic pressure did very well in certain cases, but were not generally applicable. They were succeeded by a contrivance called the "accumulator," which consists of a pluger or ram working in a vertical cylinder, and loaded with a sufficient amount of weight to give the requisite pressure by having the water forced into the cylinder by manual labor or steam power.

The invention of the accumulator may fairly be looked upon as the starting point for the development of modern water-pressure machinery, for by it water of very high pressures can be stored up in any situation, and may be distributed to various machines at great distances apart by comparatively small pipes. (The usual pressure being 700 lbs. to 1,000 lbs. per square inch.) But in certain notable cases this pressure has been much exceeded; as, for example, in the chain and anchor testing machinery erected at Sunderland for the British Government, by Messrs. J. Abbot & Co., of Gateshead, the ordinary daily working pressure is 2,000 lbs. per square inch. The accumulator thus serves to produce not only an artificial head of water, but also stores up the amount of pressure water not required at the time by rising to the top of its stroke; by which action the supply of steam is cut off, and the speed of the pumping engine reduced.

Within the last few years the application of the hydraulic system has been greatly extended, and is capable of still further increase. Within a short distance of this lecture room the author has seen a hydraplic machine exercising the force of a few pounds in driving a sewing machine with great regularity. In another case the Tyne Swing Bridge, weighing about 1,600 tons, is sustained and worked with great precision by the hydraulic system.

The members will have an opportunity of judging of the efficiency of the system in this case, as well as at the works of Sir W. G. Armstrong & Co.; the 100-ton sheers at Elswick, in which a suspended cylinder takes the whole weight direct without the intervention of chains; the 80-ton crane on New-

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* To prevent misapprehension, we have been asked to state that Mr. Ross has no connection with any firm in the North. He was formerly with Sir W. G. Armstrong & Co., but is now an independent Consulting Engineer.—Ed. G. S. J

castle Quay; the grain warehouses; and the Forth Banks Goods Station of the North-Eastern Railway.

Hydraulic machinery is especially suitable where the work to be done is intermittent, as in cranes, hoists, capstans, lifting purifier covers in gas works, etc., as it admits of the use of one small steam or gas engine for generating the pressure by charging the accumulator, which may be placed on any part of the works distant from the machines; the power or capacity of each machine being determined by the capacity of the accumulator only, and the frequency of the operations would determine the power of the steam engine. When there are several machines working, the accumulator should be of such a capacity as to be able to supply in one stroke the maximum number of machines likely to require a charge at one time. Thus an unlimited number of intermittent machines may be worked from the same steam engine and accumulator, and being at great distances from each other, if required, still retaining their efficiency; for the loss of pressure in the pipes is very small, and varies inversely as the fifth power of the diameter.

Mr. Robinson, in a paper read before the Institution of Civil Engineers, says that gauges have been placed on a main composed of 4-inch, 3-inch, and 2-inch pipes, in the Great Western Railway Yard at Paddington, from 1,000 to 1,600 yards apart, and the pressure has been found to be practically the same during the working of the machines in the usual way, being slightly higher at the accumulator. At Swansea, whenever the pressure in the main has been tried, it has been found to be uniform.

The friction on rams, direct-acting, with cupped leathers, has been determined very carefully by Mr. Hick, of Bolton, who has shown that for a 10 inch diameter of ram the loss is only 0.4 per cent.; for a 20-inch diameter of ram, 0.2 per cent., and so on; the percentage of loss being inversely as the diameter, for while the power varies as the square of the diameter, the friction varies as the diameter. For hemp packing the friction is greater, being 2 per cent. in accumulators 17 inches diameter at 700 lbs. per square inch. In ordinary crane work the Elswick firm find the following to be an ample allowance for friction:

Direct-acting ram			93	per cent efficiency.
2 to 1 multiplying power of sheaves			80	" "
4 to 1	"	"	76	" "
6 to 1	"	"	72	" "
8 to 1	"	"	67	" "
10 to 1	"	"	63	" "
12 to 1	"	"	59	" "
14 to 1	"	"	54	" "
16 to 1	"	"	50	" "

A smaller diameter of pin, a larger diameter of sheave, or a smaller chain, will give a greater efficiency.

The compounded efficiency of the steam engine and accumulator—that is, from the indicator diagram of the steam cylinder to the delivery of water from the accumulator—is from 75 to 82 per cent. Whenever steam pipes have to be carried any distance, there is not only a great loss of pressure, by the condensation of the steam and leakage at the joints, but the condensed steam must be disposed of, and great difficulty is experienced in keeping the joints tight, and in a comparatively short time it is necessary to insert fresh india-rubber in the joints. The joints of hydraulic pipes will, on the contrary, remain intact for years, subject to the highest pressures, and if a leak does occur, the loss is much less than by the leakage of steam, and can be more easily remedied. It can be shown that at the ordinary working pressures for air and water—viz., 40 to 50 lbs. per square inch for the former, and 700 lbs. per square inch for the latter—the loss of power in transmitting the former is 20 to 30 times that of the latter.

It has often been urged against hydraulic pressure, the danger of breakage from frost. However, if the pipes are laid from 2 ft. to 2 ft. 6 in. below the ground, there is not the slightest risk of the action of frost reaching them. The machine itself may be protected by a gas-jet, or if in exposed situations, the water may be run out by a drain-cock. About five per cent. of methylated spirit introduced in the water has been found to prevent it freezing.

The celerity with which ships or barges can be unloaded with hydraulic cranes is marvellous. One crane, lifting at the rate of about 10 feet per second, will perform as much as 1,000 to 3,000 tons per hour; and whilst the load is being moved at such a high speed, the machinery itself is moving quite slowly—viz., one stroke of the ram or plunger at one entire lift of the load. Where there is much dust flying about, especially coke dust, which is of a very hard and gritty nature, this is a matter of great importance, as the axles and shafts of quickly-rotating gas or steam engines are rapidly worn away, and require great and continual attention and repairs.

The simplicity of hydraulic machinery renders it capable of being worked by unskilled laborers or boys, and the fewness and simplicity of the moving parts, together with their slow motions, reduces the amount of repairs to a minimum. In a hydraulic engine at a lead mine in Northumberland, the engine-man never saw the engine for years; he was simply instructed in the use of the handles, the engineer in charge of the works examining the machinery occasionally. Another advantage of hydraulic machinery is that a machine which has been out of action for years will be ready for use at a moment's notice by merely turning on the stop-valve, there being no complication in the machinery to attend to.

The equality and constancy of hydraulic pressure renders it particularly suitable for gas works machinery, requiring, as in the case of the exhausters, great regularity and certainty of action. Moreover, water, considered practically, is, at moderate pressures such as are proposed to be used, incompressible. This gives it the power of great definiteness in working, and affords an instantaneous means of checking and controlling its action and speed.

The incompressibility of water was a very serious obstacle to the introduction of water-pressure machinery in the first instance, as the inertia of a moving mass suddenly stopped, and without an elastic cushion to take up the additional induced pressure, caused innumerable breakages of cylinders, etc.; but this difficulty was most perfectly overcome by the now well-known check and relief valves invented by Sir W. G. Armstrong, which prevent any considerable rise above the accumulator pressure in any part of the system.

For hydraulic machinery, the cost, under ordinary circumstances, has been found in various dockyards and warehouses to vary from 0·7d. to 1·89d. per 100 foot tons delivered into the mains, giving an average of 1·26d. per 100 foot tons. The cost of labor at the cranes being 0·46d. per 100 foot tons, in all 1·72d. per 100 foot tons; whereas for manual labor the cost is from six to nine times this amount. According to experiments in gas-works carbonizing 50,000 tons of coal per year, it was found that in coal-discharging, manual labor cost from 5d. to 8d. per ton; hydraulic power, 1¼d. to 2d. per ton; steam power, 2¼d. to 3d. per ton.

I propose, then, to perform all the mechanical operations in gas works by the aid of hydraulic power, as being more manageable, more reliable, costing less, and requiring less attention than any other method of transmitting and applying power. The power may be generated in the first instance by a steam engine, or by a gas engine, when, of course, the boilers would not be required. I propose for a vertical exhauster, a vertical, direct-acting hydraulic cylinder, placed immediately above a vertical rectilinear exhauster—say 3 feet diameter and 8½ feet stroke; this would give about 80,000 cubic feet of gas per hour at 12 strokes per minute. As the strains would be all self-contained, no foundations would be required, except for merely carrying the weight of the parts. The entire horizontal space occupied being about 3 ft. 6 in. square.

The hydraulic cylinder could be arranged to have a single-acting ram for the up-stroke; the return action being accomplished by a counter-weight for simplicity. The same result could be attained by a piston and piston-rod in the hydraulic cylinder. This machine could be set to work at from about one stroke in five minutes up to about 12 strokes per minute. The slightest action of the gas governor would produce an immediate action on the speed of this machine, at whatever portion of the stroke it might be, and by the aid of a supplementary valve it would be impossible to stop at any part of the stroke having no dead centres; the delivery of the gas being constant and regular, and varying only when acted upon by the governor.

In the ordinary vertical exhauster, worked from a crank-shaft, the delivery of gas during a stroke varies from 0 to 1; for two cylinders at right angles the delivery varies from 1 to 1·414. Assume the pressure of the gas delivered from the exhauster to be 20 inches of water, and on the side next the hydraulic main to be, say, four inches of vacuum, equal to a total of 24 inches of water, which is equal to 0·868 lb. per square inch, or say one lb.; then, according to Boyle's law of pressures, the full delivery and pressure of gas after the turn of the stroke will be attained when the piston has travelled over 1-16th of its stroke, which for an 8-feet stroke, at 3 feet per second velocity, will be 1-16th of a second. Or take a 4-feet stroke at 15 strokes per minute, equal to two feet per second; the time occupied from the turn of the stroke to full pressure and delivery will be 1-18th of a second; whereas, with a reciprocating exhauster, driven from a crank-shaft, the time from the turn of the stroke to the maximum delivery would be one second, and similarly for a rotatory exhauster. For a rotatory exhauster, a three-cylinder ram engine (rotatory) as employed for capstans might be used. In this case a regular motion of the engine would result in a varying delivery during one revolution, owing to the principle of this exhauster.

Where mechanical retort charging and drawing machines are used, a similar hydraulic engine might be applied by driving the endless cord at the end of the retort-house.

[Appended to the paper was a list of certain hydraulic machinery for gas works, which has been manufactured by Messrs. John Abbot & Co., of Gateshead, and the detail plans for which were exhibited on the wall during the meeting.

DISCUSSION.

Mr. F. Colyer (London) said he understood Mr. Ross to say that steam could not be carried through a long length of pipe without a great loss in condensation; but having had considerable experience both in hydraulic and steam machinery, he could not agree with him. He had carried steam 500 feet in one direction and 400 feet in another on the same wharf, with, he thought he might say, a loss of from 1 lb. to 1½ lbs. pressure per square inch. The difficulty of keeping the joints tight was nothing like so great as was represented; with proper expansion joints, and condenser boxes to take off the condensed water, he never experienced the difficulties mentioned. He spoke with some diffidence in a town like Newcastle, where there were so many gentlemen connected with hydraulic power machinery. It was not his intention to at all disparage hydraulic power in any case where it might be applicable; but he thought it was only so in large gas works. Steam power was far cheaper for small works, whether in gas works, or in other places. The first cost of hydraulic power, roughly speaking, would be nearly double that of steam, and he believed the cost of 7d. per ton for lifting by hydraulic cranes would come to nearer 1s. 8d. He should like to know what was included in that 7d. Did it include interest on money, wear and tear, and all expenses, and also a sinking fund for renewal? As to the suggestion of working exhausters by hydraulic power, he thought it would result in utter failure. Amongst the experiments which were tried, they were indebted to Mr. Hick, of Bolton, for his experiments on the friction of hydraulic collars, from which it appeared that it varied with the pressure. With regard to the cost they were informed that it was 2d. per ton for water, 3d. for steam, and 5d. to 8d. for hand power. He was desirous of knowing what expenses were included in that, for he should be rather inclined to reverse the figures. From all the experience he had had, water cost more than steam, if they took all the expenses into account. Then the speed of the crane was put at six feet per second, or 360 feet per minute, which he ventured to say would be a most dangerous speed to work at. In unloading coals, which was one of the most general things in gas works, 200 feet per minute was about the maximum speed for safety. Hydraulic machinery was originally worked on the North-Eastern Railway by Sir Wm. Armstrong, and he thought that an air-vessel could be used for small works with great advantage, where it would be impossible to have an accumulator on account of the first cost. The only difficulty was keeping it charged with air. The other details were those with which they were all acquainted. The system of raising purifiers by a modification of a ram lifting at the centre was very simple, except that, in his belief, it would be found to unduly strain the crown of the purifiers. About the neatest arrangement he had seen for a hydraulic lift was one made by Messrs. Tangye Brothers and Holman, with an ingenious arrangement for carrying the water pressure by a line of pipes with a universal joint adjustable as the traveller was moved.

The President asked if Mr. Colyer had any personal experience with that joint.

Mr. Colyer said he had not any personal experience of it, but it appeared to him to be a very nice and neat arrangement, and he believed there was no difficulty in keeping it tight.

Mr. J. Watt Sandeman said he could confirm what Mr. Ross had stated with regard to the economy and advantages attending the use of hydraulic power. About nine or ten years since he introduced at Greenock Harbor a complete hydraulic power system of cranes and hoists, which was supplied by Sir W. G. Armstrong and Company. At that time he had occasion to consider and report on the relative cost and advantages of hydraulic and steam power systems, and the conclusions arrived at were greatly in favor of hydraulic power. He should mention, as had been stated by the last speaker, that where power was required only for a limited number of machines, say one or two small cranes, probably steam would be found the least costly; but wherever it had to be supplied to several machines working intermittently, there was great economy in hydraulic power. No doubt now that machinery was to a great extent superseding manual labor in gas works, greater opportunity was afforded for the economical application of hydraulic power. It also offered great facilities for the transmission of energy to a distance, as it had been proved by experiment that even up to two or three miles (when moving at the usual velocity) there was no appreciable difference in the pressure of the water, whereas steam, without great loss, could only be conveyed to a limited distance.

Mr. P. H. Wilkinson (Harrogate) said he felt greatly interested in this question, inasmuch as they were introducing hydraulic power for various portions of their machinery. He was fitting up one hydraulic ram for the purpose of lifting the whole of their purifiers, and it would also do some other work. They likewise had a lift for raising the coke from the lower regions or firing floor to the upper, which happened to be the coke stores. He wished to ask whether Mr. Ross could give any information as to the relative value of water when delivered by gravitation, at a pressure of from 100 to 126 pounds per square inch, and the cost of working a steam engine so as to get the accumulstor to give, say, 700 lbs. if required; in other words, whether it would not be cheaper to work with water, when it could be obtained with such a pressure, than to set up an accumulator. The ram they were putting up was only in progress, therefore he could not give any results; but he should be glad to do so at some future time. The coke lift was also not yet in work, having been placed in the new retort-house in course of erection.

Mr. Ross, in reply to the first question which had been asked, as to what he proposed, said it was a simple ram or hydraulic cylinder placed at the top of the exhauster. The regularity of the motion was something which could not be equalled by steam. It was possible to act by it on the exhaust-pipe and on the pressure, and regulate it with the greatest nicety. That had been accomplished both in air and water pumping machinery, and the small space the apparatus occupied recommended it at once. With regard to the loss by using steam, which, Mr. Colyer admitted amounted to 1½ lbs. of pressure in 500 feet, when one spoke of conveying water power, it was not by feet but by miles. Even then the loss was infinitesimal. It was apparent to every one who had had experience with hydraulic power, that the water pipes required no attention; they lay buried in the ground for years, which was a great advantage. With regard to the cost of steam, hydraulic, and manual power, the figures he gave included everything; interest on capital as well as labor. Of course, if they had a very small plant, it would be slightly different. Any engineer present who had had experience in the use of steam and hydraulic power would bear him out in the statement that the cost of the latter was much below that of steam. The larger the plant the greater was the economy of hydraulic machinery; and, more than that, the greater distances apart the machines were, as well as the less frequency with which the whole was used, the greater convenience it had. With regard to the speed of lifting, he had seen cranes lift at the rate of from 8 to 10 feet per second, quite steadily, without the slightest chance of accident. The best answer to Mr. Colyer was the fact that steam plant, in the case of docks, railway goods stations, and gas works, was now being superseded by hydraulic machinery, the most recent case he had heard of being that of Beckton. In reference to the question put by the last speaker about the relative efficiency of low water pressure from the main and accumulator pressure, that could only be answered when the whole of the circumstances were stated. There was the price of water to be taken into account, and the amount of draught on the pipe. Sometimes, when they had a pressure of 120 lbs, indicated by the gauge, it was found that it was not regular; they might have a draught to the town, pulling away a very large proportion of the low pressure; whereas, with a high pressure, they were not dependent on the town main at all. As a general rule, he should certainly say, put down hydraulic plant; though, if the hydraulic machinery were worked through low-pressure water from a town main, it would not be so reliable, as they knew, unfortunately, in the case of fires.

The Future of American Engineering.

ADDRESS BY THOS. C. CLARK, Prest. Engineers' Club of Philadelphia.

GENTLEMEN:—I have chosen this subject for my address, as I know of none more personally interesting to the members of this Club, most of whom are young men who look forward to many years' practice of their profession, and whose career will be greatly influenced by the future of American Engineering.

The numbers of our profession are increased every year by hundreds of graduates from the technical and scientific schools, and by others who rise from the ranks of the great army of labor to become its leaders. All of them expect to make engineering, in some of its various branches, the profession and occupation of their lives; and all are interested to know whether there will be room and work for all.

One's first demand of his profession is that it shall give him an honest living. His next strongest wish is to find an opportunity to execute some work that shall fully call out all his abilities, and give him some measure of that fame which we all prize. Finally, he ought to wish to "pay the debt which every man owes to his profession" by making some permanent addition to knowledge either in engineering itself or in some of its kindred sciences.

If a man succeeds in but one of these three things he may be thankful; if in all, he may justly claim the title of an "eminent engineer."

The broadest and at the same time most concise definition of engineering is "scientific construction." If this be true, engineers have existed from the days when the early kings of Egypt reared the first pyramids, a thousand years before Abraham was born, down to the generation which has seen the achievements of Stephenson, of Morse, and of Eads.

But while engineers have lived and labored for so long a time, it is only of late years that they have become a distinct guild and profession. The name was first applied to the makers of canals, aqueducts, dykes, jetties, and other hydraulic constructions. Then it was extended to the makers of

railways, and now it takes in a much wider range of operations. It will be attempted to show that on the breadth and inclusiveness of this classification depends the solution of the problem of the future success of our profession.

The first question is, What preparation and education will best make a man a scientific constructor?

A great deal of discussion has taken place during the last year or two on the education of engineers. It is not intended to enlarge upon this here. Suffice it to say that we are all now agreed that education is of two kinds—that derived from books, and that obtained from some actual practice and from contact with men.

One tells us what to do, the other how to do it. They are both absolutely necessary. The more of the first kind an engineer has, or, in other words, the broader and deeper the foundations of his knowledge are laid, the more readily and intelligently will he acquire the second, and the more satisfactory will be the result of his practice. But in order that his learning may be of practical use to him, he must also have experience.

The young engineer of the present day comes to his work with a much better preparation than those of the generation before him. He must not, however, make the mistake of supposing that the eminent engineers of a past generation, who never enjoyed the privileges of the schools, were deficient in scientific knowledge. They had it, but they got it from actual experiment, and went beyond the books of their day, and were in many cases the original discoverers and investigators, the fruits of whose labor every school-boy can now enjoy.

The weak point of the old system was that, while it produced many great men, yet the average did not stand as now; and the expenditure of much capital had to be entrusted to ignorant persons, whose blunders led to enormous waste, and whose names are now happily forgotten, together with their mistakes.

The young engineer of the present day should also remember that now, as in the past, there is but one road to success. He who wishes to command must first learn to obey. He must show his superior officers that he is perfectly reliable and faithful. A man who has his mind occupied with the direction of large interests appreciates fully the wisdom of the saying, "Never do yourself what you can get any one else to do for you." But this cannot be carried out unless he feels perfectly sure that his assistants will not deceive him, that they will report things exactly as they are, and will carry out his instructions to the letter.

After a young man has shown that he can always be depended upon, he will soon be promoted into a higher rank, where the orders are more general, and where more is left to his discretion and judgment. If to faithfulness and energy he adds good judgment, and to good judgment tact, and the power of managing and controlling men, he may rest assured that before very long he will have gained the first requisite—material success. He will probably find that soon an opportunity will offer to carry out some work which will insure him a measure of reputation.

Finally, his early scientific training will have taught him to observe facts and draw deductions therefrom, he will probably, sooner or later, make some contribution to science. Even if not a writer, he will furnish some of the material of which books are made.

We have thus briefly traced the career of a successful engineer in the present condition of the profession, or rather in the immediate past. But it will be said, "The ranks are already too crowded. More and more men are coming in every day. Although we admit the truth of Webster's saying, 'there is always room at the top,' yet what shall *we* do, who are men of only moderate abilities? We do not ask nor expect the great prizes of the profession, but we cannot help thinking that in America engineers are less esteemed and less paid than in any other civilized country of the world. Will we be better or worse off in the future? Are we going up grade or down?

These are very pertinent questions, and a true answer would be of the highest interest. I will endeavor to give you my views, always bearing in mind the modest epitaph of the old surveyor, "his hind-sight was better than his fore-sight."

It has been previously stated that on the breadth and inclusiveness of the classification of engineers depends the solution of the problem of their future success. If we bear in mind that while an engineer is, unfortunately, not always a scientific constructor, yet a scientific constructor *must* be an engineer, we shall see how numerous are the paths open to us to follow and how soon the crowd will be relieved.

Let us see how the number of these paths has increased during the last half century. Before the year 1828, an engineer meant a man who knew how to make canals and water-works. But when George Stephenson created the modern railway, an engineer soon came to mean a man who could build railroads. The construction of the 85,000 miles of railroads in the United States, costing over 4,500,000,000 of dollars, has naturally given employment to the largest number of engineers. After these roads were opened for use, they still continued to employ many engineers in taking care of them and operating them.

Within the last dozen years the substitution of iron for wood, first in railway bridges and viaducts, and afterward in structures of all kinds, has developed another class of special engineers, who, being of a pushing and energetic disposition, have, perhaps, monopolized rather more than their share of public attention.

The development of our mineral wealth, in which it is estimated that over 400,000,000 of dollars have been invested during the last thirty years, may be seen reflected in the list of the Society of Mining Engineers, which numbers 734 members.

Then we have the engineers of the water works, drainage, sewerage, and of the streets and structures of our large cities. The city of Boston is now expending some 5,000,000 of dollars in its improved sewerage, surpassing, in some respects, even the gigantic works of London itself. Mr. Chesbrough, city engineer of Chicago, was once introduced to one of the European engineering society as that daring engineer who had raised a city of 300,000 people ten feet up in the air above its original position.

Allied to the preceding class we have the sanitary engineers, specialists, whose duty it is to apply scientific principles to the construction of our dwellings, too long left in the hands of ignorant plumbers and builders.

Then we have the honorable body of architects, who all ought to be engineers—i. e., scientific constructors; for, if they are not, so much the worse are their buildings.

The great gas companies now almost always employ men of scientific attainments as their engineers, the result of whose labors may be seen rather in the increase of dividends than in the lower price of gas.

But another school of specialists is coming on whose labors will correct all this—the electric engineers, whose skill has already enabled us to light our workshops more brilliantly and at less cost than the gas engineers have been able to do it.

The future of electric engineering includes not only the vast fields of electric lighting and of the telegraph, but all means of transmitting signals and, perhaps, power.

Another class of specialists has an enormous future before it in this country—I mean agricultural engineers, who, as a separate body, have existed for some years in England. When one considers the great savings that are capable of being made by the application of correct scientific principles and practice to farming operations, which are now done so loosely and by rule of thumb, who will say that here is not a great opening for engineers in the near future?

Then there is a class of engineers whose services are more and more in demand every year—I mean the engineers employed by large contractors. Some of the ablest men in England are contractors' engineers.

You will observe that for a man to succeed in any of these newer branches of our profession, he must be much more than a mere surveyor or designer and measurer of masonry and earthworks. He must be, first and foremost, a mechanical engineer, as it is termed. He must understand dynamics as well as statistics, and must be practically familiar with the construction of machinery and machine tools.

In Europe no man can attain eminence as a civil engineer who is not well versed in the mechanical part of his profession. Hence, we find them constantly called upon to design, construct, and report upon paper mills, cotton factories, sugar machinery, iron and steel works, and such things, which in this country are intrusted to manufacturers rather than to engineers.

I do not mean to say that this country is behind others in mechanical engineering—the names of Fritz and Griffen, of Sellers and Holly, forbid that; but I do mean to say that if American engineers, as a class, were better versed in the mechanical part of their profession, they would not see themselves laid on the shelf by the capitalists who throw away their money on Keely motors.

It was one of the traditions of the elder school of engineers that they should carefully abstain from taking part in matters of business. Architects and civil engineers were formerly either government officials or, as professional men, they held the same social position, which they feared would be lowered if they became business men, skilled in prices and sharp at a bargain. This was merely a survival of the old feeling of contempt which the governing classes—the men of the sword—felt for the men of affairs.

The effects of this mischievous tradition have descended to our own day, with unhappy results to the profession. I need scarcely tell you that an engineer is only half fitted for his work unless he is able to hire men and buy materials and execute his own designs, if occasion calls for it. It may seldom be necessary for him to do it, but the ability of so doing makes him a better judge of the value of a contractor's work, and a far safer estimator of the probable cost of public works.

European engineers profess to be able to do this, and this is one reason why they command their five per cent. commission on the cost of their works

and attain wealth and position, while, in this country, engineers are often paid the salaries of second rate clerks.

It has sometimes happened that, in looking for the engineer of some railroad, I have been disgusted to discover him at last hidden away in a dusty office on the upper story of a building, ignored by almost everybody; while the ticket agents, and the fast-freight agents, and the palace-car agents, and all their tribe, sit down-stairs in splendid apartments, drawing large salaries and commissions, and evidently people of the highest consideration. This is because they are first-class business men, while the poor engineer is not.

Let the engineers of the future, if they wish to prosper, learn to be men of business and control the cheque-book and the ledger. We shall then hear less of public works frightfully overrunning the original estimate of cost, and the whole profession will stand higher in public estimation. Pardon me if I say that I feel sure that whatever reputation I myself have is due to the fact that the public feel confident that I can and will execute my own designs within my estimates both of cost and time.

From what has been said you will see that my views of the future prospects of engineering in America are not gloomy.

The truth is, that it is by engineers, whether called by that name or not, that America has been made what she is to-day. The Fultons, the Morses, the Ericssons, the Howes, the McCormacks and the Edisons are engineers, although their names may never have been enrolled on the lists of learned societies; while among those whose names are to be found on such lists, who is there in any country who ranks above Jervis, Latrobe and Eads?

Follow, therefore, in their footsteps. The field is vast, for it covers the whole area of scientific construction, while the laborers are even yet but few. From the brilliancy of the past we may predict the greater glories of the future. Some of us who are passing off the stage may not live to see them, but there are young men in this room who may one day behold greater triumphs of engineering than the world has yet seen.—*Proceedings of Engineers' Club of Phila.*

Fire in Petroleum and Tar Distilleries.

The terrible disaster that has lately occurred at Philadelphia, by which the premises of the Atlantic Petroleum Refining Company has been almost entirely destroyed, cannot fail to awaken an interest in the subject of fire extinction amongst those members of the community whose capital is represented by tar stills and shale retorts. As no insurance company will grant a policy for either a tar distillery or mineral oil works, it becomes a matter of paramount importance that there should be some ready and simple, yet effective, means always at hand with which to check the ravages of such a dangerous element, should it unfortunately break out in a locality where all circumstances are in the most favorable condition for aiding the spread and strengthening the power of the flame. The precautions usually taken in such works account in a great measure for the security in this country against disasters similar to that which has resulted in the destruction of so much valuable property and material in America. But the exciting cause of the Philadelphia conflagration is one which may at any time cause a similar disaster nearer home. It is one over which managers have no control. Lightning, when travelling on its destructive mission, does not stop to select this building or that. Whatever be the best and nearest conductor, thither it is attracted, be it tar distillery or powder magazine; and the only course to pursue is to attempt to confine within a limited area the destruction that must inevitably follow. In a tar distillery the naphtha portion, both of the crude and manufactured material, is of a highly combustible nature, and decisive action must be taken at once. If time be lost, all is lost. In an oil work, on the other hand, many of the finished products are non-combustible in themselves, though they can be classed as supporters of combustion, and if applied to a conductor, render it very inflammable. Innumerable chemical means have been proposed from time to time for the purpose of extinguishing fire; but all have failed, more or less, from their impracticability. Carbonic acid gas was amongst the earliest of the proposed substances, and was to be generated from chalk and sulphuric acid. The efficacy of such a vapor in choking out flame cannot be denied; but the application of it is another question, especially as in such works as we are now writing about most of the manufacturing operations are carried on, practically speaking, in the open air.

Another objection to the use of the gas, and one that most writers on the subject seem to have overlooked, is that in passing over burning woodwork and the like it takes up another, atom of carbon, and becomes converted into an inflammable gas, viz., carbonic oxide, which would tend rather to feed the flames than to extinguish them. Supposing, however, this were not to happen, but the gas retained its primitive composition, another disadvantage arises—the vapor is so irrespirable that, although not poisonous, yet animal life is immediately destroyed by inhaling it, thus rendering it impossible for firemen and others to assist in subduing the fire. All these matters being considered, along with others which we have not alluded to, but which will be obvious to any practical mind, show that we cannot look for any benefit from this agent.

Another substance which we have seen used with good effect is the acid sodium sulphate ($NaHSO_4$), a bye-product in the manufacture of vitriol and nitric acids; but this is not a substance always at hand, and therefore need not be further dwelt upon.

A proposition was made some little time back by Mr. Watson Smyth, F.C.S., to use ammoniacal liquid, on the supposition that the ammonia contained therein became decomposed, at a high temperature, into nitrogen and hydrogen, and that these gases acted as a choke, so to speak, and put out the fire. This has been tried with some success, but we must think the action is more complicated than Mr. Smyth states. Be that as it may, it is undoubtedly a valuable aid to the tar distiller and petroleum refiner should he meet with an accident in the way of fire explosion. Ammoniacal liquor is always at hand, and is always in communication with the pumps about the works, this alone being a matter of no small importance.

Lastly, but not least, we have a simpler remedy, as efficacious as any yet mentioned, in ordinary sand. This acts mechanically, and not chemically, simply by excluding air and literally burying the flames. We have seen a still burst on more than one occasion, and all danger removed in a few moments by a few shovelfuls of sand applied with discretion and expedition. We consider this material to be the one par excellence, for the prevention of fire in oil works, and one that commends itself to the notice of all managers engaged in such dangerous occupations, not only for its efficacy, but also for its simplicity of application and easy procurability. A few heaps of sand (or earth, which answers equally well,) might be arranged in the vicinity of the stills and at other parts of the yard, and there need not be much cause for apprehension if a fire does burst out. Cool judgment and a little sand will speedily remove all danger, and it is a matter extremely to be regretted that some such means were not tried at the recent disaster in America. Water in such a case is useless, if not harmful, and, while water is sometimes scarce, there never need be a want of sand or damp earth.—*Journal of Artificial Light.*

A Proposition to Supply Philadelphia with Cheap Light.

We cut the following from Philadelphia papers:

A proposal has been laid before the trustees of the gas works by a company to furnish gas at 50 cents a thousand cubic feet. If the arrangement can be made on a purely business basis, and removed from all political association, the officers of the new company say the gas to be furnished will be of standard candle power and of uniform composition, consisting chiefly of hydrogen, and not carbonic oxide.

"It will be a permanent gas, and not a condensable vapor. No deposits of lampblack will be formed in the mains or service pipes, and no tar in the retorts or elsewhere. No offensive odor will be emitted during the process of manufacture, and no lime or other purifiers will be required."

The process under which this can be accomplished is known as the "Gill process." It is claimed that 1,000 feet of gas can thus be made with four gallons of naphtha and twenty-five pounds of coal, costing for these materials nearly 19 cents. The Gill process lies in the production of a nearly pure hydrogen by the action of superheated steam on incandescent coal. The hydrogen is to be used as a fuel in a wide range of metallurgical operations. By the addition of a small amount of carbon in gas or vapor, it is held that the cheapest and best illuminating gas can be produced, and of greater uniformity, brilliancy, and heating power than ordinary coal gas.

If the contract is consummated, it is claimed that the Gas Trust can supply light to consumers at $1 a thousand feet, where now $2.15 is charged. If the city prefers a royalty the new company offers to pay 10 cents per 1,000 cubic feet, thus reducing the cost of the gas below 50 cents, as the actual cost is less than 40 cents per 1,000 feet. The Gas Trust is now considering the applications of several companies owning patented processes, and it is understood that a test is to be made as to the relative merits of the different plans.

THE PRICE OF GAS TO BE REDUCED.

For some months past the trustees of the gas works have had under discussion the question of the present price of gas, and a proposition has also been made to reduce it. At each meeting of the trustees the matter has been considered, but nothing of a definite nature done. At the last meeting the officers were asked to prepare a statement of the affairs of the works, in order that an intelligent view of the question may be had. That the price will be reduced there seems to be no doubt; in fact, one of the trustees to-day informed a *Telegraph* reporter that as soon as this statement was prepared a reduction would be made, but how much he was unable to say. It is said that some of the trustees are in favor of at once reducing the price from $2.15 per thousand cubic feet, the present rate, to $2 per thousand, while others of the members are disposed to thoroughly examine the different patented processes by which outside parties claim to be able to manufacture gas at almost nominal rates, and then select the best, and give consumers the benefit of the decreased cost of production.

Correspondence

Gas Engines.

ELKHART, IND., Aug. 8, 1879.

Mr. Editor :—While quite a number of gas companies have been paying especial attention to the introduction of gas stoves in their respective cities, we have been trying to introduce gas engines, in our little town, and have thus far succeeded in getting two firms to purchase engines; and as they are giving perfect satisfaction in every respect, we concluded that some figures, giving the results of their workings, would be of interest to the gas fraternity in general.

The first engine was put up by Messrs. Chase and Kent, proprietors of the *Evening Review*, last October, and has been in constant use ever since. It is an Otto and Langen upright engine, 1½-horse power, and is used for driving one Potter cylinder press, 25″ × 35″ bed; one Chicago Taylor cylinder press, 20″ × 30″ bed; one one-eighth medium Gordon press, and extra heavy shafting, etc. For the nine months to Aug. 1st it has used 25,200 cubic feet of gas, at $3 a 1,000 (the price here), would make the cost $75.60, or an average of $8.40 per month. Or, to give a better statement, we will take last months working. There were 27 working days, and they averaged 6 hours per day, making 162 hours for the month, and costing $9 for gas, or 3.7 cents per horse power per hour.

The other engine was put up in May last for Messrs. J. F. Funk & Bro., who do general printing, etc. It is one of the new Otto Silent Gas Engines, 4-horse power, and is used for driving two 3-inch cylinder pumps, for pumping into a tank 30 feet high the water used for sprinkling the streets, amounting to about 800 bbls. per day, and also one Taylor cylinder press, 31″ × 46″ bed; one medium Potter cylinder press; one Sanborn 30″ paper cutter. This engine runs 10 hours per day, and for the two months used 25,900 cubic feet of gas, which cost $77.70; or, 52 working days, 10 hours per day, would be 520 hours, making the cost 3.7 cents per horse power per hour.

Messrs. Chase and Kent were getting their power from a machine shop next door, paying $20 per month, which they thought was pretty cheap, until they purchased their gas engine, which does the work for $8.40 per month. Messrs. Funk & Bro. used a 10-horse power stationary engine and boiler. This required an engineer and fuel amounting to $800 a year. As they do not need more than half the power during the six months of cold weather, when they do no pumping, it is safe to say that the gas will not cost them over $400 per year. Add to this $100 for heating their building, in place of the steam used from the old boiler, and they will still have a saving of $300. This will pay for the engine in two years.

Neither engine requires any attention whatever except oiling occasionally, and can be started and stopped when wanted.

I am not able to say which of these engines is the best, as we have not had the new one at work long enough yet. Both are working splendidly, and each party claims it has the best engine. Very respectfully yours,

E. H. JENKINS,
Supt. Elkhart Gas Light and Coke Co.

Use of By-Pass on Steam Pipe of Exhauster Engine.

OFFICE CITY GAS LIGHT COMPANY,
NORFOLK, VA., August 5, 1879.

Mr. Editor :—In one of the weekly newspapers devoted to newly patented inventions, there appeared recently a description of a so-called new gas exhauster governor. The new points in this governor appear to be that there is "a perforated diaphragm with adjustable apertures across the bottom of the gasholder, which prevents too great movements or changes, and checks the oscillations." There is also a by-pass to the governor in the steam pipe, "to prevent delays." And it is further stated that this has never been used but in the ——— works.

Without in the least questioning the merits of this new exhauster governor, it is, however, proper to state that it a mistake to say that this by-pass had never been used elsewhere than at the place named, and through the medium of your valuable paper I would respectfully call the attention of gas men generally to the proper use to which this by-pass, or the steam pipe of an exhauster engine, can be put.

In the article referred to above it is stated that this by-pass is used to prevent delays. We do not use it for that purpose but to assist the exhauster governor in regulating the speed of the engine. We have an ordinary governor here, and over a year ago, wishing to pack the governor valve, I caused a second steam pipe, independent of that connected with the governor, to be connected with the engine. Finding afterward that by turning on just enough steam to move the engine, with the independent valve, jointly with steam passing through the governor valve, the governor regulated the engine much better than it did before, I made a permanent arrangement of it, and have used it for over sixteen months now, and feel confident that it will work well anywhere if applied as described. As it is easy of application, it may be worth a trial to any of your readers using an exhauster governor and engine. Besides, there is another matter to which the attention of gas engineers might be properly called. It is the utter absurdity of the usual heavy fly-wheel on exhauster engines. Steam engines employed to drive other machinery are supplied with a heavy fly-wheel principally for the purpose of taking up power suddenly released, or giving power instantaneously until the regular engine governor can increase or decrease the amount of steam required. For example, let us suppose a lathe in a machine shop, requiring 2-horse power to drive it, is suddenly stopped by running the driving belt on to the loose pulley; the engine, were no fly-wheel used, would immediately start up with increased speed, until the governor checked the flow of steam, and the irregularity in the speed of the engine would be very apparent, if not dangerous to other machinery connected with it. But in this case the fly-wheel would take up the power released, and the difference in speed would be scarcely perceptible. Were the same lathe started, instead of the engine running slower the momentum of the fly-wheel would give us temporarily the difference of power required until the governor could act. The office of the fly-wheel, therefore, we find to be primarily and principally to act as a reservoir of power. Secondly, the fly-wheel assists the engine to pass over the so-called dead centres—that is, when the engine, being at the end of its stock, can exert no power. In marine engines fly-wheels are never used, and governors but rarely, because the resistance to the engine is always nearly equal, and the momentum of the paddles or screw is generally enough to carry the engine over the dead centres.

Having explained the use of the fly-wheel in engines used for ordinary purposes, let us see what service it is in an exhauster engine. Do we need a heavy fly-wheel to carry our engine over its centres? No. Is an exhauster engine required to keep up a certain uniform rate of speed for any length of time? Why, of course not. The fact is that when the pressure in the gas main changes even so much as would equal the power exerted by a column of water one square inch in area and one-tenth of an inch high, we have delicately constructed governors, with balanced valves, which are very sensitive, and which at once decrease or increase the quantity of steam admitted to the engine. And is the speed of the engine changed thereby at once, too? No. Why? The answer to this question ought to be as plain as the nose on a man's face, after one understands the action of a heavy fly-wheel as generally seen on exhauster engines. The steam jet exhauster acts far superior to the rotary exhauster, so far as regularity of action is concerned, but then it has no fly-wheel, though it has its drawbacks, too, which, with your leave, I may explain at some other time.

Yours respectfully,
FREDERIC EGNER.

Coal Gas versus Water Gas.

OFFICE NATIONAL COAL GAS COMPANY,
320 BROADWAY, NEW YORK CITY.

Editor of the Gas Light Journal :

In your issue of the 2d inst. I notice an article under the above heading, from the *New York Trade Reporter*, which will justify criticism. The article proposed "to show, in brief, the nature of the claims set forth by the water gas companies with respect to the wonderful illminating power claimed for the substance distilled from hard coal, and petroleum, or the products of the latter."

Could the writer of that article have had any proper conception of water gas, when he speaks of it as "the substance distilled from hard coal"? And when his premises are so faulty, what wonder that his whole argument is full of errors?

He seems to think it absolutely funny that it should be claimed that such a gas, made under a patent, should be superior to gas made "by the ordinary process from bituminous coal, and a saving thereby of from 25 to 50 per cent. to the consumer, such a truly wonderful discovery," that it reminds him of nothing so *apropos* as the experiment of a miserly farmer who, for cheapness, fed his horse on bean straw until he died; and, as a culmination of the very funny ideas of this *Trade Reporter*, he says: "It requires only one more discovery—patented, of course—on the part of the water gas companies, to save the lucky consumer the remaining 50 per cent. and his gas bills would be wiped out altogether." The point is as clear as mud.

Does this *Trade Reporter* entertain the same ludicrous ideas of all improvements—especially of all patented improvements? Or does he claim that such a thing as saving 25 or 50 per cent. by any new invention, has been, and is, an absurdity too great for serious consideration? Rip Van Winkle's 20 years sleep must have been a mere nap compared to *Trade Reporter's* dense obliviousness to what has been passing in the circles of "trade." And this may account for the absurd comparison of values made

by him between coal gas and illuminating water gas, if he means actual, practical results, which are what are wanted in these days.

It is capable of proof that will stand any fair and impartial examination, that water gas of 17 candle power, properly made, furnishes far more light, of a whiter, more brilliant, and, therefore, more diffusive character, than can, by any skill, be produced from coal gas of any candle power that can be made available without artificial aid to its combustion; and the reason of this is perfectly plain and simple. The non-illuminant or inflammable part of water gas has a calorific intensity of flame about 70 per cent. greater than the non-illuminant or inflammable part of coal gas; and, as light is the effect of heat, it follows, as a natural result, that the atoms of carbon forming the illuminants in water gas are heated to a more intense degree than those in coal gas; and the intensity of this heat in water gas is such that, when the illuminants are raised to whiteness, they are entirely consumed, and there is consequently no smoke. While in coal gas about 47 per cent. consists of marsh gas, of a low calorific intensity of flame, and, hence, the illuminants are raised only to a comparatively dull, or yellowish white, and if at all rich (as it is called) much of it passes off unconsumed in smoke; and this is unavoidable, unless man's skill can change nature and give marsh gas the calorific intensity of hydrogen. As well may one insist that an iron heated to a red heat, if held up in the dark, will give just as much light as if heated to a white heat. It is simpls impossible.

But *Trade Reporter*, in his biased, and evidently prejudiced judgment, asserts that "all the rest of what should prove beneficial is negatived by the large proportion of carbonic oxide, and other impurities, which enters into the elements of its production." This is a mere assertion, and contrary to the fact in so far as it regards the water gas with which I am familiar. If he knows it to be true of any water gas it simply goes to show that such gas is not made perfectly, or in the best manner, and proves nothing against the principle of water gas. I affirm that coal gas contains more impurities, and, in its use, is more detrimental to health than water gas; and this will, in the near future, be proved and acknowledged by our impartial and best scientific men.

Again, *Trade Reporter* says: "These non-illuminants are absorbents, as indicated by a pale blue flame." Does he mean that all blue flames are absorbents, and, therefore deleterious! But what color does he suppose the non-illuminant part of a coal gas flame is? Is it not blue? Look at it as it issues from the burner before the light appears.

Again, he says that "an actual loss of 20 per cent. takes place in bringing water gas to a good standard of excellence." This is another mere naked, unfounded assertion, unless he refers to water gas made in some particular way with which I am not familiar; but he has no right to make a general assertion to that effect of water gas.

There can be no question that a far greater actual loss takes place in bring ing coal gas "to a good standard of excellence" than water gas. The best gas scientists tell us that in making coal gas not one-half of the gas elements in the coal are utilized. And every practical man and careful observer knows that the old method is very wasteful, and the loss of good material is necessarily very great.

Again, *Trade Reporter* says: "Gas made from bituminous coal contains about five per cent. of carbonic oxide, while water gas contains, by analysis, from 26 to 36 per cent." This is also a mistake, and misleading. Completed illuminating water gas, properly made, contains about 25 per cent. of carbonic oxide.

But *Trade Reporter* says: "If this statement be true, as is vouched for by eminent chemists, the question of illuminating power is not the only one to be considered."

Some very eminent chemists and scientists assert that man sprang from monkeys; but I do not deem it equal to "Holy Writ." Some eminent chemists say that carbonic oxide is more poisonous than carbonic acid gas. Well, if carbonic acid gas is poisonous at all, it is a wonder that there is not in every house, more than "one dead." We drink it freely as a most refreshing beverage, and give it freely even to children; and yet I never knew or heard of any one being poisoned by it. Now, as carbonic acid gas is composed of two atoms of oxygen and one of carbon, and carbonic oxide of one atom of oxygen and one of carbon, it would seem that the latter may be twice as poisonous as the former. But if the former is not poisonous at all, then how stands the latter.

It is unquestionable that carbonic acid gas is irrespirable, and that neither men, beasts, or birds can live in it, any more than they can with a "Turkish bowstring" around their necks, or with their heads plunged under pure spring water. And so is carbonic oxide irrespirable. Neither of them contains any element to support life, and if any one, like an eminent chemist, should pump his lungs free of atmospheric air, and undertake to see how long he could live on carbonic oxide, he might be excusable if he ever afterward swore it was poisonous.

But what has the *Trade Reporter* to say of the 4 per cent. of light sulphuretted hydrogen (otherwise called marsh gas or fire damp) contained in coal gas? Does it say nothing about it, or of ammonia, or other impurities in coal gas, because he thinks they are healthy to "birds and small animals," and to "persons of weak habit, and those liable to affections of the heart, or laboring under pulmonary difficulties and affections of the throat and air passages?" Does it not know how fatal fire damp is to life? Of all that scientists have proved, written, or guessed at, has it ever been shown that one life has been lost by carbonic oxide to every 1,000 that have been lost by marsh gas or fire damp?

Is there any coal gas manufacturer, or any body who uses coal gas, and knows anything about it, who claims or pretends that coal gas is not dangerous if allowed to escape? Why this studied effort, by one who would appear to be impartial, to hold up one gas, of which he evidently knows very little, as dangerous, while another gas, which he must well know is dangerous, he passes by as though it were harmless? With a very elaborate collation, by an able chemist of high standing, of the experiments and opinions of scientists in regard to carbonic oxide, published a few months ago in the Gas Light Journal, I did not discover one single instance in which it was shown that either man or beast would live one moment longer in coal gas than in water gas, or revive any more readily from its effects.

But, suppose that pure carbonic oxide is very poisonous; has it ever been shown that, when united with a large per cent. of hydrogen, its natural properties are not so changed as to render the product as safe as ordinary coal gas?

The *Journal of Chemistry* tells us that "tea is a narcotic poison; its essential principle, theine, is allied in composition with such poisons as strychnine and morphia." Why not denounce tea?

Now, as a practical matter, over 80,000,000 of feet of water gas have been made at the small city of Poughkeepsie, within a little over four years past, and men have worked in trenches and tunnels, making connections and stopping leaks, precisely the same, and with no greater precautions than with coal gas, and yet not a single instance is known of any injurious effect experienced by any employee or consumer. And I ask whether, in all fairness, this is not sufficient to stop the effort to make people believe that water gas is one particle less safe than coal gas?

But, *Trade Reporter* says: "Water gas is no new thing; patents for its manufacture date back to 1810"; and—"At Strasburg an accident occurred which put a stop to its use."

That reminds me of Rev. Mr. Beecher's story of a country dog who saw a squirrel run into a stone wall, and barked furiously all day at the hole where he seemed to enter, and for a long period afterward that dog would, in season and out of season, rush to the spot and bark at the hole in the wall, as though he thought he would make people believe that the squirel was still there.

Now, the squirrel at which the *Trade Reporter* is barking at has not been in that hole for more than ten years past.

It ought to be known to everybody who writes on the subject that all of the experiments in Europe to make water gas were made with iron retorts, and proved failures; and so also in this country. Until within a few years it was here demonstrated that only fire-clay retorts could stand a heat sufficiently great to perfectly decompose steam, and also that the true method was discovered here of causing every particle of steam to come in contact with the surface of incandescent solid carbon, by a regular, continuous process, and unvarying heats, and thus accomplish the object in the most perfect manner possible. It is, therefore, in every sense, an "American hydrocarbon process."

Had coal gas companies before this recognized the fact that the public demand a better gas than can be made from coal, and had yielded to that demand, it would have saved them a loss of many millions of dollars, and it is not yet too late to save a greater loss. They know that they have made their utmost efforts to make coal gas that will satisfy the public, and yet many thousands of their former customers will use oil in preference to thin gas. In Poughkeepsie, for 25 years, only 268 street lamps were lighted with gas; and now, in four years after the new company started, 542 street lamps burn water gas, and not one customer has ever returned to oil. Are not these facts worth at least the attention of coal gas companies?

New York, Aug. 9th, 1879. H. P. Allen.

Office Harlem Gaslight Co., 2048 Third Av.,
New York, August 1st, 1879.

The price of gas supplied by this Company on and after this date (until further notice) will be for those using

Less than 5,000	cubic feet	per month,	$1.90	per 1,000	cubic feet.
5,000 to 10,000	"	"	1.85	"	"
10,000 to 20,000	"	"	1.75	"	"
20,000 to 30,000	"	"	1.65	"	"
30,000 to 40,000	"	"	1.55	"	"
40,000 to 50,000	"	"	1.45	"	"
50,000 to 70,000	"	"	1.40	"	"
70,000 to 85,000	"	"	1.35	"	"
85,000 to 100,000	"	"	1.30	"	"
100,000 to 150,000	"	"	1.25	"	"

Over 150,000 cubic feet per month, a further reduction will be made.

Wm. H. Osborn, *Secretary.* Robert W. Rodman, *Vice-President.*

THE AMERICAN GAS LIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.

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This is a recognized official organ of—
LIGHT, HEAT, STEAM, WATER-SUPPLY,
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SATURDAY, AUGUST 16, 1879.

Official Report of Examinations of Gas for two Weeks ending Aug. 9, 1879, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

July 1879.	Time of Day at which Test were made.	New York Gas-Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
28	Between 9.30 A.M. and 1 P.M.	16.58	16.96	18.34	17.26	16.57	
29		16.60	17.16	18.55	17.29	16.45	
30		16.56	17.00	18.67	16.98	16.18	
31		16.30	16.87	17.78	17.51	16.40	
Aug. 1		16.71	17.16	19.78	17.37	16.35	
2		16.72	17.17	19.40	17.81	16.24	
	Average	16.58	17.05	18.75	17.37	16.36	
4		16.95	17.16	19.22	17.26	17.19	
5		17.20	17.72	19.19	17.60	16.72	
6		16.86	17.55	19.23	17.52	16.54	
7		16.64	17.58	17.89	17.82	16.48	
8		17.29	17.28	18.22	17.86	15.24	
9		17.12	17.40	18.87	17.83	16.11	
	Average	17.01	17.45	18.77	17.65	16.55	

Sugg-Letheby burner.
E. G. LOVE, Gas Examiner.

Opening Bids for Public Works.—Bids were opened last week by the Commissioner of Public Works of New York, in the presence of the Comptroller, for furnishing and delivering 1,225 tons of straight cast iron water pipe and one hundred tons of branch pipes and special castings, for which the lowest bidders were the Warren Foundry and Machine Company—$32,023.75.

The Electric Light.

The following, from a most glowing advocate, gives the other side:

"This wonderful invention is making great and giant strides. Our clever contemporary, the gas world paper, does not now pooh-pooh the invention nor the possibility of its becoming universally useful—in fact, this last week it echoes our remarks made months ago on seeing the practical application of the Werderman system, and now admits that this mode of using the light may possibly come into general use. The lighting of a principal thoroughfare like the Victoria Embankment, from end to end for six months without a failure of any kind, is a great fact, and as it is proved that the lighting can be extended for some three or four miles from the engines, we think the new light is lifted out of the phase of speculation, and must be classed among the practical inventions of advanced science. We are told by the experts that at the present time every railway terminus in the metropolis could be lighted from the little shed at Charing-cross; and if this is so we fancy only a little time is required to prove the new mode of lighting up large interiors a profitable transaction both to those supplying the light and the proprietors of large buildings."

OUR EXCHANGES.

United States.

[*Engineering News.*]

Coatsville (Pa.) Gas Works are to be improved by substituting clay for iron retorts.

The Westboro (Mass.) Water Works have been completed, and the first test was made on the 20th inst. The works have cost $28,000.

The water commissioners of Plymouth, Mass., have awarded a contract to H. R. Worthington, of this city, for a compound condensing engine of a capacity of one and one-half million gallons each 24 hours.

There being 30 feet through the jetties, and a navigable depth of 26 feet at the Head of the Passes, the works at Port Eads have virtually come to an end, and only a small force is required to finish up the works.

Arrangements have been made between the commissioners of the Norristown (Pa.) Asylum and the Norristown Water Co., by which the latter will supply the asylum with water for $2,500 a year. Gas for use in the institution will be manufactured on the grounds.

The West Springfield (Mass.) Aqueduct Company, Goodhue and Birnie, proprietors, have lately contracted with the Boston and Albany Railroad Company to furnish their round-house at West Springfield with water for five years. The price paid is $500 per year, and five fire hydrants have been put in for fire protection.

The contract for the pumping machinery for the proposed new water works at Monticello, Ia., has been let to the George F. Blake Manufacturing Co. for $1,200. Coverdale & Cowell, of Cincinnati, have the contract for the street work. The building of the reservoir, up to latest advices, had not been let. The new work entire will cost about $11,000.

The Haverhill Aqueduct Co., of Haverhill, Mass., which is one of the oldest water works companies in the country, having been established in 1804, have recently contracted with Goodhue & Birnie of West Springfield, Mass., to lay upward of nine miles of wrought iron cement-lined pipe in connection with the high-service works recently established there.

Captain M. R. Brown, United States Engineer, has forwarded official information to the Hon. Secretary of the Treasury that the maximum depth required by the Jetty Act, namely, thirty feet, has been secured through the jetties. After four years of labor the Mississippi is, therefore, fully opened to the commerce of the world.

A Providence, R. I., correspondent of a Boston paper, referring to the water works system of the former city, says: "An interesting machine is the automatic pumping engine at the Hope station of the water works for the high service. It has ten cylinders, five for water and five for steam, arranged alternately in a circle. Of course it has an enormous capacity, but it will, without attention from the attendant, do the duty of pumping either for a single faucet or for a dozen steam fire-engines. The cylinders are all connected to a single central upright shaft, which automatically makes either one revolution in five minutes or 25 in one minute, according to the water required. If the fire burns low, the engine will open the damper. If this is not sufficient it will put on the blower. This grand engine has been subjected to the severest tests."

Labor in Europe and America.

WASHINGTON, Aug. 5.—The reports from the United States consuls on the condition of labor in the several countries of Europe, as prepared for publication by the Department of State, show:

1. That wages in the United States are double those of Belgium, Denmark, France, and England; three times those of Germany, Italy, and Spain, and four times those of the Netherlands.

2. That the prices of the necessaries of life are lower in the United States than in Europe, and that the laborer in the United States, were he satisfied with the scanty and miserable fare upon which the European laborer must live, can purchase like food for less money than it can be purchased for in Europe.

3. That the French working people, with far less wages are happier than the working people of Great Britain, who receive the highest wages in Europe, on account of the steadiness and the economical habits of the former, and the strikes, drinking habits, and consequent recklessness of the latter.

4. That more misery results from strikes, drinking, socialism, and communism in England and Germany than from all other causes combined, hard times included.

A careful reading of these reports, the department declares, will do more to solve and settle the "labor problem" in the intelligent judgment of the country that the fragmentary investigations which have thus far been the only public inquiries undertaken by the government.—*Iron Age.*

Bridging the English Channel.

LONDON, Aug. 6.—The *Standard's* Paris despatch says M. Venard de St. Anne, the originator of the project for bridging the English Channel, promises to begin operations without delay. He estimates that it will require seven months for experiments, and that 1,000,000 francs will suffice to pay the preliminary expenses.

To raise funds he has laid the project before the French and Belgian chambers of commerce. Eighty-four of these have already expressed themselves in favor of the project. He will visit England shortly to lay the matter before the English government.—*Iron Age.*

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks, (with W B Scott & Co.,)

24 Pine Street, New York City.

August 16, 1879.

☞ All communciations will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

Gas Co.'s of N. Y. City.

	Capital.	Par.	Bid.	Asked.
Central	466,000	50	60	75
Harlem	1,800,000	50	40	45
" Bonds	170,000			103
Manhattan	4,000,000	50	145	150
Metropolitan	2,500,000	100	115	120
" Scrip	$1,000,000	...	100	103
Mutual	5,000,000	100	50	55
" Bonds, gold	900,000	1000	100	105
Municipal	1,500,000	100	115	120
" Bonds	750,000		105	110
New York	4,000,000	100	87	90
Northern	270,000	50	—	100

Gas Co's of Brooklyn.

Brooklyn	2,000,000	25	110	115
Citizens	1,200,000	20	50	60
" S. F. Bonds.	320,000	1000	100	102
Peoples	1,000,000	10	18	25
" Bonds	325,000	...	--	95
" Scrip	300,000	...	75	80
Metropolitan	1,000,000	100	40	50
Nassau	1,000,000	25	50	60
" Ctfs.	700,000	1000	80	85
Williamsburgh	1,000,000	50	70	75
" Scrip		...	90	95
Kings Co	200,000	100	—	70
Union Co. E. N. Y.		25	—	50
Richmond Co., S. I.	300,000	...	60	85

Out of Town Gas Companies.

Bath, Maine	70,000	100		
Buffalo Mutual, N.Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md	2,000,000	100	95	98
" Ctfs., gold	1,000,000		95	10
Bayonne, N. J		100		90
Brockport, N. Y	25,000	100	...	80
Citizens, Newark	918,000	50	100	103
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			128	130
Cincinnati G. & C. Co.				190
Derby of Conn	160,000	100	60	80
East Boston, Mass		25	114	120
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind.		100	...	—
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	120	125
Hempstead, L. I.	25,000	100	...	—
Jersey City	750,000	20	145	155
Jamaica, L. I.	25,000	100	...	—
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	70	80
Lima, Ohio,	60,000	100	—	...
Bonds	30,000		90	
Laclede St Louis Mo.	1,200,000	100	—	75
Long Branch		20	30	40
New Haven, Conn		25	152	—
Peoples, Jersey City		...	—	80
" " Bds.				95
Peoples of Albany	650,000	100	—	10
" Bonds	350,000	1000	—	—
Peoples of Baltimore		25	44	48
" Bonds			106	—
Plainfield, N. J	80,000	100	—	105
Perth Amboy		25	—	95
Rochester, N. Y		50	70	80
" Citizens		100	50	60
Toledo, Ohio			95	97
Washington, D. C	1,500,000	20	—	200
" Scrip	500,000	20	100	—
Yonkers		50	70	80
Woonsocket, R. I.	150,000	100	80	...
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
Pittsfield, Mass			120	130
Rondout & Kingston			75	80
St. Louis Missouri	600 000	50	72	75
Stillwater, Minn	50,000	50	—	26
Saugerties, N. Y	15,000	100	95	100
Troy, Citizens	600,000	100	—	60
San Francisco Gas-Co., S. Fr'isco Cal.			95	95½

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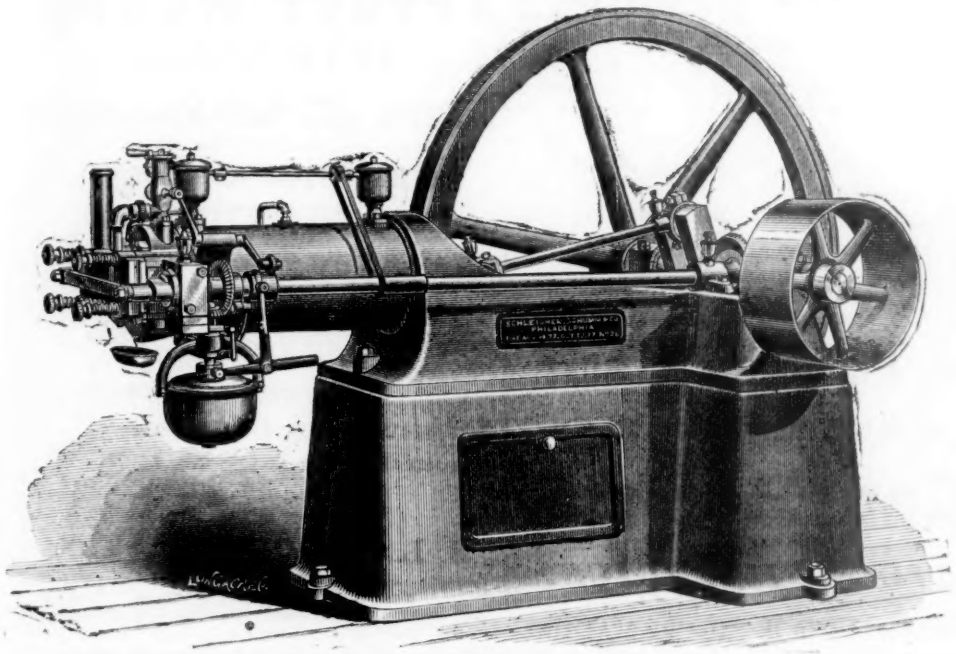

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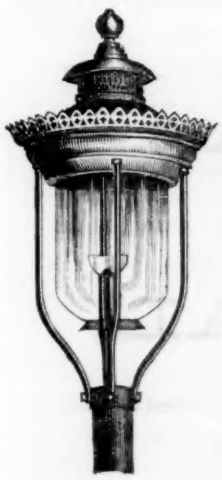

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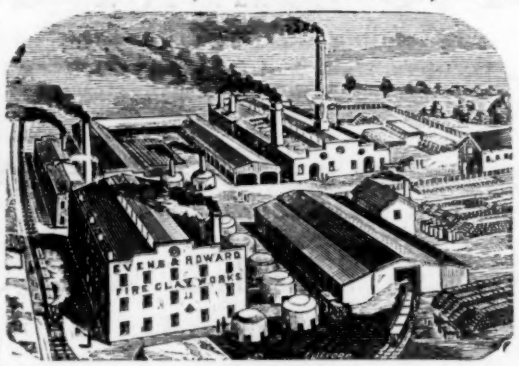

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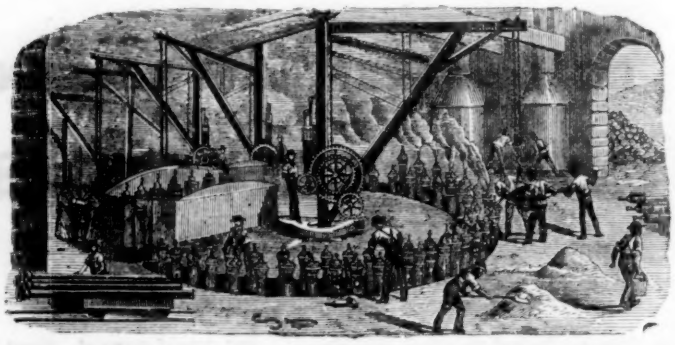

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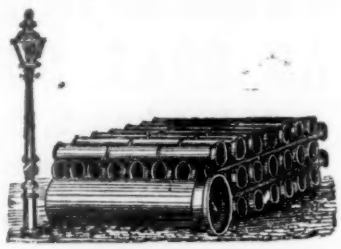

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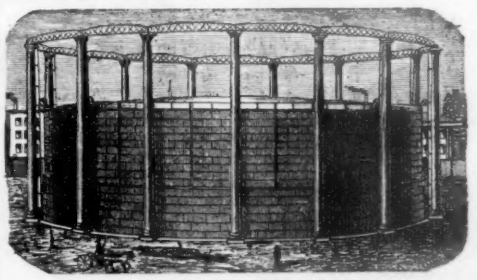

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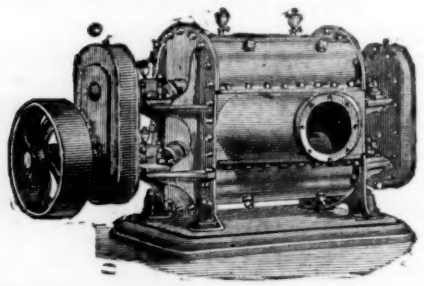

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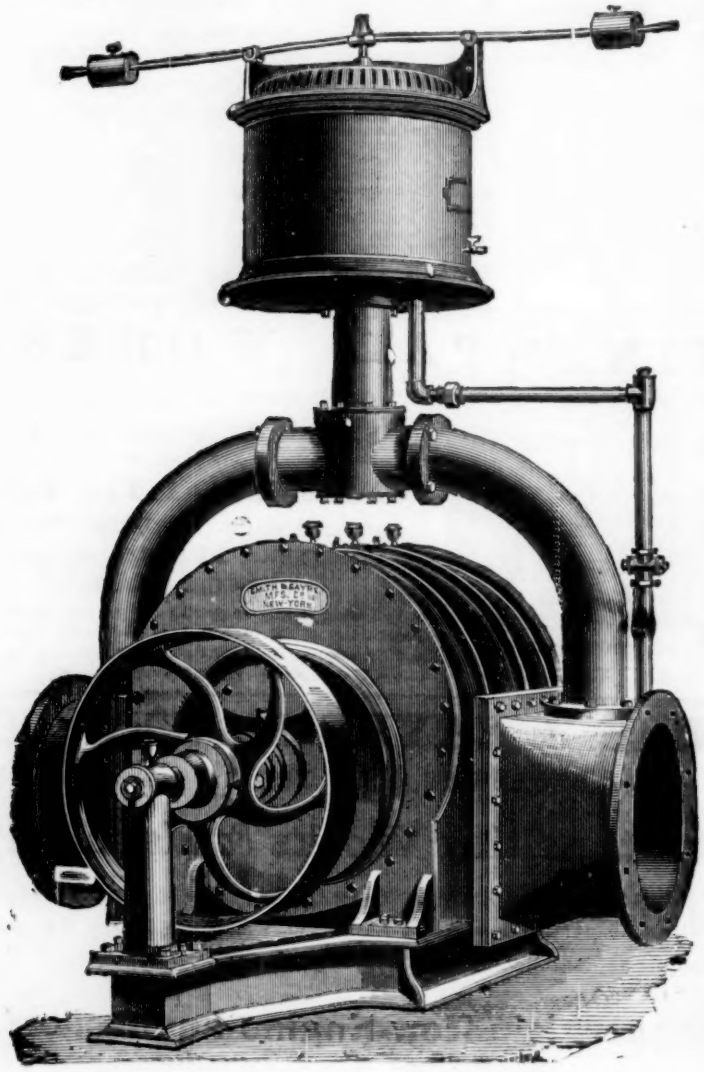

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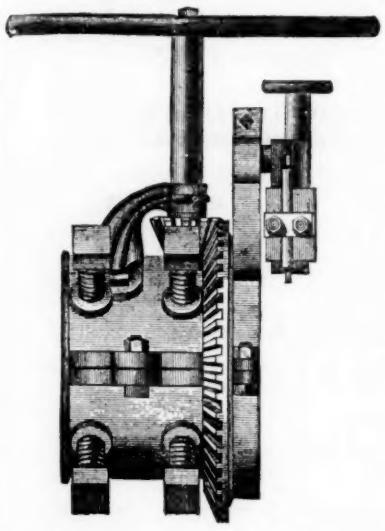

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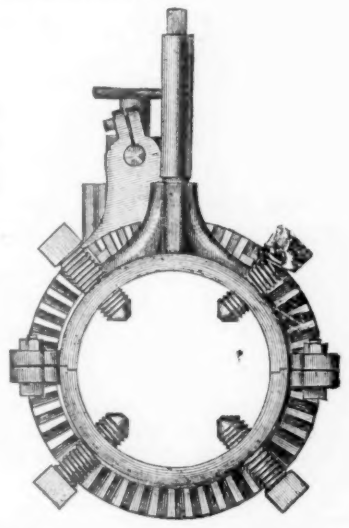

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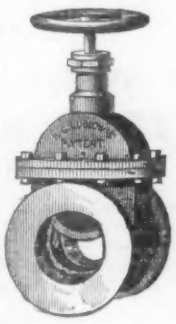

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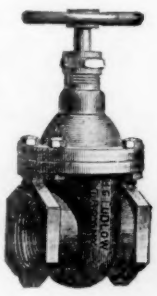

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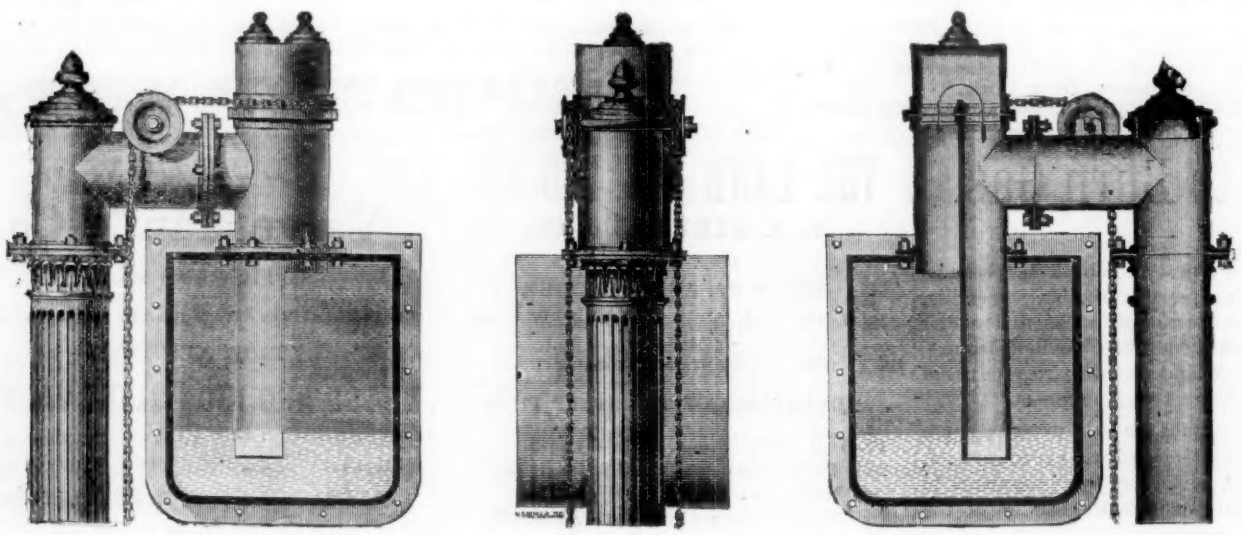

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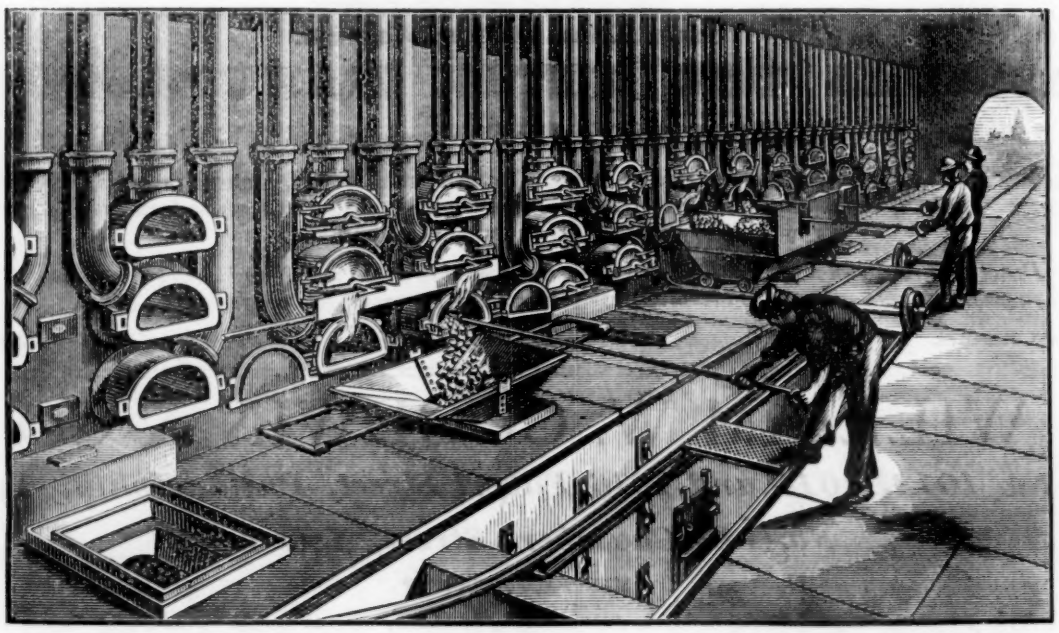

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